PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

2.35 : 531.55 : 533.6.013.4 1692

Generalised Routh–Hurwitz discriminant. SHERMAN, S. *Phil. Mag.*, **37**, 537–51 (*Aug.*, 1946).—A method is devised for finding the number of roots of an algebraic equation (with complex coefficients) which lie in various regions of the complex plane, e.g. line segments, half-planes, infinite strips, quadrants, polygons, circles or circular sectors, etc. Applications are made to some aircraft flutter calculations and the method may be applied to other problems, e.g. ballistics, retarded control systems, airplane and helicopter dynamical stability problems. L. S. G.

2.942 : 530.145.6 = 4 1693

An extension of the vector calculus with applications to wave mechanics. CAZIN, M. *C.R. Acad. Sci., Paris*, **222**, 992–4 (*April* 24, 1946) *In French.*—A distinction is made between the left and right components of a vector, thus: $V = a_1i + b_1j + c_1k = ia_2 + jb_2 + kc_2$, where (a_1, b_1, c_1) are the right, and (a_2, b_2, c_2) the left components. Vector and scalar products are defined in the use of the left vector calculus, and it is shown that various vector quantities associated with a moving particle combine according to this calculus in the theory of wave mechanics. L. S. G.

12.942 : 530.145.6 = 4 1694

Symbolic derivation in the vector calculus. CAZIN, M. *C.R. Acad. Sci., Paris*, **222**, 1079–81 (*May* 6, 1946) *In French.*—Continuing previous work [Abstr. 1693 (1947)], symbolic differentiation with respect to time is defined, and this is used to define velocity vector operators in wave mechanics. These apply particularly in the case of relative motion. L. S. G.

517.9 1695

Some improvements in the use of relaxation methods for the solution of ordinary and partial differential equations. FOX, L. *Proc. Roy. Soc. A*, **190**, 31–59 (*June* 17, 1947).

517.9 : 621.396.11 1696

A variational method for determining eigenvalues of the wave equation applied to tropospheric refraction. MACFARLANE, G. G. *Proc. Camb. Phil. Soc.*, **43**, 213–19 (*April*, 1947).

517.944 = 4 1697

On systems of linear partial differential equations, in four variables, which are invariant under all Lorentz transformations. POTIER, R. *C.R. Acad. Sci., Paris*, **222**, 638–40 (*March* 18, 1946) *In French.*—The variables are components of a spinor. Three systems of spinor equations are set up, such that every equation which is invariant under Lorentz transformations may be decomposed into equations of these systems. L. S. G.

517.946.9 : 530.145.6 1698

On the theory of boundary perturbations. WASSERMANN, G. D. *Phil. Mag.*, **37**, 563–71 (*Aug.*, 1946).—Methods are given for solving a wave-equation which is slightly different from one whose exact solution is known, e.g. a slight change in the boundary or the boundary conditions. The discussion is restricted to the Schrödinger equation. L. S. G.

518.2 1699

Special values of $e^{k\pi}$, $\cosh(k\pi)$ and $\sinh(k\pi)$ to 136 figures. UHLER, H. S. *Proc. Nat. Acad. Sci., Wash.*, **33**, 34–41 (*Feb.*, 1947).—Values are given for $\pm 1/k = 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 64, 96, 192$. L. S. G.

518.42 : 548.73 *see Abstr.* 1975

518.5 : 621.389 1700

A high-speed electronic function generator. MACKAY, D. M. *Nature, Lond.*, **159**, 406–7 (*March* 22); MYNALL, D. J., *ibid.*, 743 (*May* 31, 1947).—[Abstr. 1784 B (1947)].

518.5.088.3 : 621.395.645 = 82 1701

Investigation of the influence of amplifier parameters in matrix schemes. GRADSHTEIN, I. S., AND TAFT, V. A. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 1) 63–71 (1946) *In Russian.*—Electrical calculating machines, making use of quadrupole amplifiers in addition to R, L and C elements, are discussed briefly, and a mathematical analysis of their accuracy, with particular regard to the effect of large coupling capacitors, is presented. A. L.

519.21 = 3 1702

Theory of probability. VON WRIGHT, G. H. *Acta Soc. Sci. Fennicae* (*Ser. A*) **3** (*No.* 11) 66 *pp.* (1945) *In German.*—The abstract theory is developed on an axiomatic basis, with the aid of mathematical logic. Inductive probability is discussed fully. L. S. G.

519.21 : 539.16.08 *see Abstr.* 1936

519.25 1703

On the radial error in a Gaussian elliptical scatter. DARTIN, D. *Phil. Mag.*, **37**, 636–9 (*Sept.*, 1946).

ASTRONOMY . ASTROPHYSICS . GEODESY 52

523.161 1704

The physics of cosmic grains. CERNUSCHI, F. *Astrophys. J.*, **105**, 241–53 (*March*, 1947).—An analysis of the theories on the formation of condensations of matter in space. The density, diameter and probable electrical charges of interstellar particles are discussed. E. G. M.

523.165 : 523.854 1705

Interpretation of radio radiation from the Milky Way. TOWNES, C. H. *Astrophys. J.*, **105**, 235–40 (*March*, 1947).

523.2 : 530.12 = 4 1706

Some observations and new experiments. PRUNIER, F. *Arch. Sci. Phys. Nat.*, **28**, 121–78 (*July–Aug.*); 192–228 (*Sept.–Oct.*, 1946) *In French.*—I. The planets of the solar system are considered, and it is shown that if a is the semi-major axis of the orbit of a planet, $a^2 = n^2A/m$ where A is an expression depending upon the eccentricity, m is the mass of the planet and n is an integer or half-integer. It is also shown that m/a is the square of an integer or the ratio of squares of small integers; and that the mutual ratios of the moments of momentum for the planets are ratios of small integers. Other results of this nature are obtained. In II the possibility of verifying certain results in the theory of kinematical relativity by astronomical observations is discussed. In III the results of some optical experiments made in a rotating system are described, and the bearing of these on the theory of relativity is discussed [Dufour and Prunier. *J. de Phys. Radium*, **3**, 153 (1942)]. L. S. G.

523.7 1707

On the distribution of the solar general magnetic field, and remarks concerning the geomagnetism and the solar rotation. WALÉN, C. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 3)

Paper 18, 63 *pp.* (1947).—Rotation in the sun's core is supposed to keep convection parallel to the axis, save during periodic convulsions. Electromagnetic forces oppose any motion in the magnetic field, and supply a "rigidity" to the material. In the outer layers, Nernst currents are important. The radial limitation of the field is explained in terms of turbulence. T. G. C.

523.823 1708

Luminosity functions of the brighter stars. ABRAMS, J. W. *Astrophys. J.*, **105,** 268–82 (*March*, 1947).—A calculation by two methods. The material is limited in various ways to isolate supergiants from giants. Comparisons with determinations by other workers are given. E. G. M.

523.841.1 1709

Magnitudes and colour indices of Nova Aquilae 1945. SCHALÉN, C., AND WALLENQUIST, A. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 3) *Paper* 15, 14 *pp.* (1947).—Photographic magnitudes by two different instruments and methods, with photovisual and visual values, are given for Aug.–Nov., 1945. The light curves and colour variations are briefly discussed. D. L. E.

523.852.21 1710

Small dark nebulae. BOK, B. J., AND REILLY, E. F. *Astrophys. J.*, **105,** 255–6 (*March*, 1947).—Describes a search for small dark nebulae, termed globules, on good photographs of emission nebulae. Their distribution, apparent and true diameters are discussed. E. G. M.

523.854 : 523.165 *see Abstr.* 1705

523.87 : 535.33 *see Abstr.* 1811

523.874 : 535.338.334 171

On the broadening of neutral helium lines in stella spectra. KROGDAHL, M. K. *Astrophys. J.*, **105,** 327–4 (*March*, 1947).—A detailed investigation of several H lines in the case of τ Scorpii shows that the broadening o these lines is mainly of the collisional type. L. I

523.877 171

Stellar models with convection and with discontinuity o the mean molecular weight. LEDOUX, P. *Astrophys. J.* **105,** 305–20 (*March*, 1947).—A discontinuous outwar decrease in mean mol. wt. μ at the boundary of th convective core is shown to produce a temporary ex tension of the convective region, which rapidly smooth out the discontinuity, leaving a transition zone in whic $\mu \propto M(r)P^{7/5}$. Results taking this zone into account diffe very little from those when the change in μ is discontinuous T. G. C

523.877 171

Stellar models with isothermal cores and point-sourc envelopes. HARRISON, M. H. *Astrophys. J.*, **105,** 322–((*March*, 1947).—Continues earlier work [Abstr. 99 (1942), 575 (1943)]. Values between 1 and 2 are con sidered for the ratio of mean mol. wts. in core an envelope. T. G. C

525.24 : 538 : 530.1 *see Abstr.* 1715

525.624 : 551.543 *see Abstr.* 1990

526.77 : 550.831 = 5 *see Abstr.* 1985

PHYSICS 53

53 1714

Further notes and suggestions on the teaching of physics. SMITH, C. J. *Phil. Mag.*, **37,** 505–34 (*Aug.*); 579–605 (*Sept.*, 1946).

FUNDAMENTALS 530.1

530.1 : 525.24 : 538 1715

The magnetic field of massive rotating bodies. BLACKETT, P. M. S. *Nature, Lond.*, **159,** 658–66 (*May* 17, 1947).—The relation $P = \beta G^{\frac{1}{2}}U/c$ between magnetic moment P and angular momentum U (G = gravitational const., c = vel. of light, β = constant $\simeq 1$) holds for the sun and the earth, and is now shown to be satisfied by the star 78 Vir. [see Abstr. 1413 (1947)]. It is suggested that the relation represents a fundamental law of nature. The other theories of the magnetic field of sun and earth are discussed, and shown to be unsatisfactory. The possibility of further tests, including laboratory experiments, is explored.

530.12 1716

A critical examination of Milne's kinematical relativity. BAND, W. *Phil. Mag.*, **37,** 551–63 (*Aug.*, 1946).—A careful study is made of Milne's theory and it is adversely criticized in most places. Recently published comments on the theory are reviewed. It is concluded that the theory is "justifiable only as a stimulant of interesting discussion." L. S. G.

530.12 : 523.2 = 4 *see Abstr.* 1706

530.12 : 535.11 *see Abstr.* 1796

530.12 : 538.3 1717

A spherically symmetrical non-static electromagnetic field. NARLIKAR, V. V., AND VAIDYA, P. C. *Nature, Lond.*, **159,** 642 (*May* 10, 1947).—The most general solution satisfying the relativistic equations of electromagnetism, and incorporating the line element published earlier [Abstr. 2513 (1943)] is given.

530.12 : 539.152.2 *see Abstr.* 1928

530.14 1718

Recent research in meson theory. WENTZEL, G. *Rev. Mod. Phys.*, **19,** 1–18 (*Jan.*, 1947).—A comprehensive and thorough review. Topics discussed include tensor-forces, mixed theories, strong coupling theories, and subtraction theories. The λ-limiting process is also discussed and Stueckelberg's development of the theory according to Heisenberg's S-matrix method is described. Full references to the literature are given. L. S. G.

530.14 1719

Pais' *f*-field theory and the mirror nuclei. WIGHTMAN, A. S. *Phys. Rev.*, **71,** 447–8 (*April*, 1 1947).—It is shown that the *f*-field theory [Abstr. 684 (1946)] in its present form cannot simultaneously account for the neutron-proton mass difference and the binding energy differences of mirror nuclei. A.

530.14 = 3 1720

Remark on the deuteron problem. VILLARS, F. *Helv. Phys. Acta*, **19** (*No.* 5) 323–54 (1946) *In German.*—The Hamiltonian function for a 2-body system is written down, and a variational method is described for solving the Schrödinger equation. The meson theory of a 2-nucleon system is developed. The influence of tensor forces is investigated. It is shown that if the experimentally determined binding energies of the two S-states (^3S and ^1S) are used, the excitation energies of the isobars is limited to values exceeding 200 MeV. The effect on proton-neutron scattering is studied. L. S. G.

530.14 = 5 1721

Integration of the meson-field equations. CALDIROLA, P. *Ric. Sci.*, **13,** 195–8 (*April–May*, 1942) *In Italian.*—Solutions to the equations are obtained by an operator

thod introducing Bessel functions J_T; the particular egral is a generalization of the retarded potential of electromagnetic field. The special case of a single int particle fixed in space is considered. J. A. W.

0.14 = 5 1722

Clifford's algebra and the meson equation. SALVETTI, C. *uovo Cim.*, **3**, 250–82 (*Aug.*, 1947) *In Italian.*—Clifford's gebra is applied to transcribe the meson field equations a 5-dimensional continuum. It is shown how in such ace the equations that are usually employed to describe meson field can be re-united in a particularly simple gle one which is valid both in vacuum and in polarizable dia (i.e. in presence of nucleons), where both electric d magnetic moments can be taken into account. In an empt to clarify the physical meaning of the fifth mension, it is shown to be essentially connected with particle rest mass. The extra co-ordinate x_5 repre- nts the length of geodesic which is described by the rticle in its motion in the 4-dimensional continuum of e special relativity theory ("proper time"). The omentum conjugate to x_5 appears to be $\mu_0 c$ (μ_0 = rest ass of the particle), and the two conjugate variables and $\mu_0 c$ appear to satisfy an uncertainty relation. A.

0.14 : 537.122 = 3 *see Abstr.* 1862

0.14 : 539.152.1 1723

Electromagnetic properties of nuclear systems on meson eory. MØLLER, C., AND ROSENFELD, L. *K. Danske idensk. Selsk. Mat.-fys. Medd.*, **20** (*No.* 12) 66 *pp.* 943).—A continuation of previous work [Abstr. 740 947)]. The electromagnetic properties of arbitrary fields e discussed and in particular the properties of a system nucleons and mesons are investigated. The canonical ansformation separating the static meson fields is applied the interaction of the system with the electromagnetic ld. Expressions for the electric dipole and quadripole oments and the magnetic dipole moment are obtained, nd these contain terms of the exchange type, depending on both the nucleon and meson variables. The results e applied to the deuteron. L. S. G.

0.14 : 539.152.1 1724

Non-central coupling in the mixed meson theory of uclear forces. ROSENFELD, L. *K. Danske Vidensk. elsk. Mat.-fys. Medd.*, **23** (*No.* 13) 17 *pp.* (1945).—The mmetrical mixed theory of nuclear forces is described, nd application is made to the deuteron problem. The elocity-dependent coupling yields the right sign and order f magnitude for the deuteron quadrupole moment, but ppears to cause a large perturbation of the energy of the round state. The latter difficulty is now overcome, and he physical meaning of the coupling is clarified; in the vo-nucleon case it reduces to axial dipole interaction. elocity-dependent coupling in the neutral mixed theory briefly discussed. In this theory there is no alternative o the cut-off procedure to explain the quadrupole oment of the deuteron. L. S. G.

30.14 : 539.152.1 1725

Meson fields and nuclear interaction. KLEIN, O. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 1, 19 *pp.* (1947).— theory of nuclear interaction is formulated in analogy ith the field theory of electric interaction, mesons taking he place of photons. The starting point is 5-dimensional elativity theory. Field equations are found and simplified o yield equations for free mesons. The wave equation or nucleons is derived. L. S. G.

30.14 : 539.152.1 1726

Probability of nuclear meson-absorption. GAMOW, G. *Phys. Rev.*, **71**, 550–1 (*April* 15, 1947).—To account for he factor of 10^{12} between the charged meson nuclear heory and certain experimental results, such as the absorption of negative mesons, it is proposed that the exchange forces between nucleons are due to the exchange of neutral mesons. W. E. D.

530.14 : 539.185.7 1727

Collisions of neutrons with deuterons and the reality of exchange forces. MASSEY, H. S. W., AND BUCKINGHAM, R. A. *Phys. Rev.*, **71**, 558 (*April* 15, 1947).—Results of recent scattering experiments [Abstr. 1000 (1947)] are compared with the authors' theoretical calculations [Abstr. 2721 (1941)] and they indicate the presence of an exchange type of force between nucleons. [Note: Fig. 2 is printed in error on p. 563]. W. E. D.

530.145 1728

A note on relativistic second quantization. CHANG, T. S. *Proc. Camb. Phil. Soc.*, **43**, 183–95 (*April*, 1947).—The quantization of free bosons [Abstr. 1742 (1942)] is extended to fermions (i.e. particles obeying Fermi–Dirac statistics). Relativistic wave equations are proposed, after suitable creation and annihilation operators have been defined, and their consistency conditions are studied. L. S. G.

530.145 1729

On the elimination of certain divergencies in quantum electrodynamics. GUSTAFSON, T. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 2, 9 *pp.* (1947).—Interaction is considered between an electron and an electromagnetic field. The work of a previous paper [Abstr. 679 (1946)], where a finite expression for the second approximation of the electron self-energy was obtained, is now extended to a treatment of the self-energy produced by forced oscillations of the electron under the action of the vacuum field fluctuations. In this, Dirac's equation is solved by Riesz's method of analytic continuation. A finite value is obtained for this self-energy on the assumption of positive-energy photons only, thus avoiding Dirac's introduction of negative energy photons. L. S. G.

530.145 1730

Two applications of the variational method to quantum mechanics. KOHN, W. *Phys. Rev.*, **71**, 635–6 (*May* 1, 1947).—By using the unperturbed wave function with a variable scale factor as trial-function for a perturbed Schrödinger equation, a lower bound for the 2nd-order perturbation energy of the ground state in terms of the unperturbed and 1st-order perturbation energy is obtained. A minimum property of the sum of the n lowest proper values is utilized in a new method for obtaining higher proper values and functions. A.

530.145 = 4 1731

Vector current definition. POTIER, R. *C.R. Acad. Sci., Paris*, **222**, 855–7 (*April* 8, 1946) *In French.*—An expression is given for the vector current for particles of $\frac{1}{2}$-integral spin in terms of spinors associated with a system of Lorentz-invariant equations with four variables, discussed in an earlier paper [Abstr. 1697 (1947)]. W. E. D.

530.145 = 4 1732

On the definition and properties of the vector current associated with a particle of arbitrary spin. POTIER, R. *C.R. Acad. Sci., Paris*, **222**, 1076–9 (*May* 6, 1946) *In French.*—Previous work [Abstr. 1731 (1947)] is extended, and the reality of the vector current is examined. Expressions for the divergence of the vector current are obtained, and the vanishing of these yields equations satisfied by the current. L. S. G.

530.145 : 536.7 *see Abstr.* 1860

530.145.6 = 4 1733

Applications of first integrals in wave-mechanics. Properties of the moment of momentum of a system of particles. VIARD, J. *C.R. Acad. Sci., Paris*, **222**, 53–9

(*Jan.* 2, 1946) *In French.*—It is shown that, by a suitable change of variables, first integrals may be used to find solutions of the wave equation and the corresponding proper values. This may be used to solve the equation which relates to a system of particles. L. S. G.

530.145.6 = 4 1734

On the centre of gravity of two particles of spin ½. SLANSKY, S. *C.R. Acad. Sci., Paris*, **222**, 994–6 (*April* 24, 1946) *In French.*—The centre of gravity is taken to be a point in space-time, and the conditions are discussed under which the wave equations of the particles admit solutions which depend only upon the centre of gravity. L. S. G.

530.145.6 : 512.942 = 4 *see Abstr.* 1693–4

530.145.6 : 517.946.9 *see Abstr.* 1698

530.145.63 1735

General properties of the characteristic matrix in the theory of elementary particles. I. MØLLER, C. *K. Danske Vidensk. Selsk.*, **23** (*No.* 1) 48 *pp.* (1945).—It is shown that the Heisenberg *S*-matrix [Abstr. 2109 (1944)] is unitary and invariant under Lorentz transformations. Collision cross-sections may be given in terms of the elements of this matrix and the invariance property is used to find a number of general "constants of collision," i.e. variables which commute with *S* and with the total kinetic energy. L. S. G.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 533.7 1736

Errata: Statistical mechanics of transport processes II. Transport in gases. KIRKWOOD, J. G. *J. Chem. Phys.*, **15**, 155 (*March*, 1947).—See Abstr. 1133 (1947).

531.252.2 1737

On a derivation of the equations of equilibrium of a thin plate. OLDROYD, J. G. *Phil. Mag.*, **37**, 648–51 (*Sept.*, 1946).—The method used by Jeffreys [Abstr. 203 (1942)] is modified to avoid the difficulty in the use of a certain pair of non-commuting differential operators. The equations obtained satisfy Rayleigh's boundary condition. L. S. G.

531.258 1738

Mixed boundary conditions in the relaxational treatment of biharmonic problems (plane strain or stress). FOX, L. *Proc. Roy. Soc. A*, **189**, 535–43 (*June* 3, 1947).

531.382 : 541.18.043 1739

An approximate solution of the differential equation of the ultracentrifuge. ARCHIBALD, W. J. *J. Appl. Phys.*, **18**, 362–7 (*April*, 1947).—An approx. solution is given for the equation

$$\frac{1}{r}\frac{\partial}{\partial r}\left\{\left(D\frac{\partial c}{\partial r}-\omega^2 rsc\right)r\right\}=\frac{\partial c}{\partial t}$$

where r = distance from the axis of rotation of any point in a cell placed within the rotor, ω = angular vel. of rotation, c = conc. when the equilibrium state has been reached, D = diffusion const. of the solute and s = sedimentation constant.

531.391 1740

The motion of a conical coil spring. EPSTEIN, I. *J. Appl. Phys.*, **18**, 368–74 (*April*, 1947).—The elongations and natural frequencies are derived theoretically for several dynamic boundary conditions. Frequencies are verified experimentally on nickel and piano wire springs. A.

531.55 : 533.6.013.4 : 512.35 *see Abstr.* 1692

MECHANICAL MEASUREMENTS 531.7

531.766 : 778.37 = 82 1741

Photoballistic method of studying very short bursts of light. TSUKERMAN, V. A. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 6) 863–74 (1946) *In Russian.*—The short burst of light (10^{-7} to 10^{-6} sec) is used to photograph a rifle bullet in flight and the duration of the burst estimated from the spread of the image obtained. D. S.

531.787 = 82 1742

Effect of connecting tube on manometer readings of pressure variations. CHARNUI, I. A. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 3) 355–60 (1946) *In Russian.*—The distortion of the phase and amplitude of rapid pressure variations caused by the connecting tube to a recording manometer are discussed theoretically. D. S.

531.787 : 536.423.15 1743

Studies in vapour pressure measurement. II. A new all-glass manometer sensitive to 0·001 mm. BALSON, E. W. *Trans. Faraday Soc.*, **43**, 48–53 (*Jan.–Feb.*, 1947).—The force required to lift a "lid" off a very accurately fitting seat, when the vapour pressure above is pressing the lid down, is measured. The manometer depends on the attainment of an almost vacuum-tight joint without the use of any grease. The maximum sensitivity was 0·001 mm, and one of the instruments could measure pressures up to 5 mm. Good agreement was obtained with dynamic measurements of vapour pressure, on brombenzyl cyanide. Vapour pressures of phenol and phenyl dichlorarsine are also recorded. A.

531.787 : 536.423.15 1744

Studies in vapour pressure measurement. III. An effusion manometer sensitive to 5×10^{-6} millimetres of mercury: vapour pressure of D.D.T. and other slightly volatile substances. BALSON, E. W. *Trans. Faraday Soc.*, **43**, 54–60 (*Jan.–Feb.*, 1947).—An instrument is described in which the recoil force produced by jets of vapour effusing through holes is measured on a torsion balance. Results closely agreeing with accepted values were obtained for Hg. A.

531.787.1 1745

The Bodenstein quartz spiral manometer. VAUGHAN, W. E. *Rev. Sci. Instrum.*, **18**, 192–4 (*March*, 1947).—Practical directions for making and mounting the spiral.

531.787.6 1746

A simple micromanometer. BROW, J. E., AND SCHWERTZ, F. A. *Rev. Sci. Instrum.*, **18**, 183–6 (*March*, 1947).—A capillary manometer of all-glass construction is described which can measure pressure differences of 0·001 in of water to an accuracy of ~ 4% in the neighbourhood of 1 atmos.

MECHANICS OF LIQUIDS 532

532.123 : 539.42 1747

The behaviour of water under hydrostatic tension. III. TEMPERLEY, H. N. V. *Proc. Phys. Soc., Lond.*, **59**, 199–207 (*March*, 1947).—Some further experiments are described which appear to confirm earlier conclusions [Abstr. 2271–2 (1946)]. Under favourable conditions, water in a glass tube can support tensions as high as 60 atmos. A simple theoretical investigation shows that the commonly held view that the tensile strength of a liquid should be numerically equal to the "intrinsic pressure" is false. For water, a reasonable theoretical value would be 500 to 1 000 atmos., and two possible explanations of this discrepancy, which is much less serious than is usually supposed, can be suggested. A.

2.137 1748
A variable speed rotational viscosimeter. BUCHDAHL, CURADO, J. G., AND BRADDICKS, R., JR. *Rev. Sci. trum.*, **18**, 168–72 (*March*, 1947).—The article gives detailed description of design and construction of an trument to measure the rheological properties of tems within a viscosity range of 10^{-1} to 10^4 poise. e use of a strain gauge to measure the torque is cussed briefly. A.

CAPILLARITY 532.6

2.612.4 : 538.65 *see Abstr.* 1915

2.612.4.08 1749
Measurement of surface tension. WEIL, R. *J. Appl. vs.*, **18**, 426 (*April*, 1947).—Sugden's method was em-yed for measuring the surface tension of distilled ter at 25°C in order to determine how the value would affected by imperfections in the circularity of the pillaries. A.

KINETIC THEORY OF LIQUIDS 532.7

2.7 : 536.7 1750
Integral equations between distribution functions of olecules. MAYER, J. E. *J. Chem. Phys.*, **15**, 187–201 *pril*, 1947).

2.74 : 534.22 1751
Sound velocity and the temperature change of molecular sociation in water. WEISSLER, A. *J. Chem. Phys.*, **15**, 0–11 (*April*, 1947).—Based on Rao's relation [Abstr. 83 (1940)], it is suggested that $d/v^{\frac{1}{3}}$ (v = velocity of und, d = density of liquid) is linearly proportional to e degree of association of liquids. Discrepancy of sults obtained from measurements at 1 Mc/s with other bservations of the variation over 0–100°C of water may due to the fact that molecular aggregates would have persist for ~1 μsec to be effective. [See also Abstr. 06 (1945)].

32.74 : 534.321.9 : 534.22.096 = 5 *see Abstr.* 1762–3

MECHANICS OF GASES 533

33.15 : 534.321.9 *see Abstr.* 1777

33.6.011.5 : 534.222.2 1752
Shock-wave and boundary-layer phenomena near a flat rface. FAGE, A., AND SARGENT, R. F. *Proc. Roy. Soc. A*, **90**, 1–20 (*June* 17, 1947).—Shock-wave and turbulent oundary-layer phenomena near the smooth flat metal oor of a specially designed supersonic tunnel are studied om traverses made with pitot, static pressure and surface ibes and from direct shadow and Töpler striation hotographs. Near-normal and oblique shock-wave stems, with or without a bifurcated foot, are considered. A.

33.6.013.4 : 531.55 : 512.35 *see Abstr.* 1692

33.662 1753
A criticism of two well-known theorems on most efficient ropellers. NAYLOR, V. D. *Phil. Mag.*, **37**, 717–28 *Oct.*, 1946).

KINETIC THEORY OF GASES 533.7

33.7 : 531.19 *see Abstr.* 1736

33.75 : 536.71 1754
A new equation of state for gases. JOFFE, J. *J. Amer. Chem. Soc.*, **69**, 540–2 (*March*, 1947)—A new equation of state in which all constants are determinable from p_c and T_c is given. In its reduced form it represents an analytical expression of the law of corresponding states. It differs from others [Abstr. 2873 (1946)] in that no fitting of experimental data is required to obtain the constants. W. R. A.

VIBRATIONS . ACOUSTICS 534

534.121 1755
On vibrations of shallow spherical shells. REISSNER, E. *J. Appl. Phys.*, **17**, 1038–42 (*Dec.*, 1946).

534.121.1 = 5 1756
Vibrations and critical pressures of annular plates subjected to radial pressure. GRIOLI, G. *Ric. Sci. Ricostruz.*, **16**, 639–42 (*May–June*, 1946) *In Italian.*—A study is made of the frequencies of the transverse vibrations and the limits to the critical pressures separating the regions of stability from the regions of vibration. L. S. G.

534.131 1757
Asymmetrical vibrations of cones. BORDONI, P. G. *J. Acoust. Soc. Amer.*, **19**, 146–55 (*Jan.*, 1947).—Measurements were made on thin-paper cones by the stroboscopic method and on metal cones by the electrostatic probe method. The asymmetrical eigenfrequencies of thin conical surfaces are shown to be independent of apical angle and to agree with those pertaining to a flat disc of the same radius and thickness, if the number of nodal diameters $\geqslant 8$. G. F. H.

534.131 = 82 1758
Theory of toroidal endovibrators. LEVIN, M. L. *J. Tech. Phys., USSR*, **16** (*No.* 7) 833–44 (1946) *In Russian.*—A precise mathematical solution of the self-oscillating conditions and frequencies of toroidal endovibrators of square and circular cross-section is attempted. The basic equation is derived, and approx. solution methods for the case of the fundamental frequency are indicated. A. L.

534.22 : 532.74 *see Abstr.* 1751

534.22 : 536.48 1759
Second sound in liquid helium II. LANE, C. T., FAIRBANK, H. A., AND FAIRBANK, W. M. *Phys. Rev.*, **71**, 600–5 (*May* 1, 1947).—With a resonance method, the velocity has been determined as a function of temperature from ~1·4°K to the λ-point. It is 0 at the λ-point, reaches a maximum of 20·46 m/sec at 1·7°K and decreases to 19·80 m/sec at 1·42°K. The accuracy of the measurements is at least $\pm 0{\cdot}5\%$. The results are in good agreement with the theoretical predictions of both Tisza and Landau but tend to favour the former's theory over the latter's. The fact that second sound generated in the superfluid is able to register on a microphone diaphragm immersed in the fluid is discussed. A.

534.22.094.1 : 534.321.9 : 534.845 1760
Measurements of ultrasonic absorption and velocity in liquid mixtures. WILLIS, F. H. *J. Acoust. Soc. Amer.*, **19**, 242–8 (*Jan.*, 1947).—The absorption (α) and velocity (V) of sound in liquid mixtures were measured at 4 frequencies (ν) in the range 3·8–19·2 Mc/s, using an improved optical technique. α/ν^2 was independent of frequency and there was no measurable dispersion of acoustic velocity. A.

534.22.096 : 534.321.9 1761
Temperature coefficient of ultrasonic velocity in solutions. WILLARD, G. W. *J. Acoust. Soc. Amer.*, **19**, 235–41

(*Jan.*, 1947).—Measurements were made, at 10 Mc/s, in liquids and liquid mixtures. All except water had large neg. temp. coeffs. in the range of 0–80°c. Water has a large pos. coeff. at room temp., decreasing to zero at 74°c, then becoming neg. (with a peak velocity of 1 557 m/sec). Solutions in water of other liquids (and of some solids) give parabolic velocity/temp. curves like that for water but with the peak velocity and peak temp. values shifting with the conc. of the solution. Increasing the conc. raises the peak velocity slightly and lowers the peak temp. markedly from the values for water alone. A.

534.22.096 : 534.321.9 : 532.74 = 5 1762

Dependence of the velocity of ultrasonics on the temperature in the mixture of ethyl alcohol and carbon tetrachloride. DERENZINI, T., AND GIACOMINI, A. *Ric. Sci.*, **13**, 27–31 (*Jan.*, 1942) *In Italian.*—Previous investigations [Giacomini and Pesce. *Ric. Sci.*, **11**, 605 (1940)] and the general properties of mixtures of polar and non-polar liquids are reviewed. Tables and graphs give the results of experiments at various temps. (5°–45°c) and concentrations. The velocity varies linearly with temp. and the temp. coeff. $k = -3\ \text{m.sec}^{-1}\ \text{deg.}^{-1}$ The velocity/conc. curves all show an initial min. at about 2–4% alcohol, followed by a linear rise, confirming the molecular constitution of the mixture. J. A. W.

534.22.096 : 534.321.9 : 532.74 = 5 1763

On the velocity of propagation of ultrasonics in the mixture of methyl alcohol and carbon tetrachloride. DERENZINI, T., AND GIACOMINI, A. *Ric. Sci.*, **13**, 542–7 (*Oct.*, 1942) *In Italian.*—Using the same experimental technique as in a previous investigation [Abstr. 1762 (1947)] the characteristic velocity v. temp. at various concs. of alcohol, and velocity v. conc. at various temps., were obtained. The latter show the min. at low conc. indicative of molecular association and the participation of non-polar molecules (CCl_4) in the mechanism of transmission. J. A. W.

534.222.1 1764

Fluctuations in intensity of an acoustic wave transmitted through a turbulent heated lamina. RUDNICK, I. *J. Acoust. Soc. Amer.*, **19**, 202–4 (*Jan.*, 1947).—The results of laboratory experiments on a beam propagated in the vicinity of a hot wire 5 m long are reported [see Abstr. 48 (1947)].

534.222.1 : 534.321.9 1765

Ultrasonic propagation in open air. SCHILLING, H. K., GIVENS, M. P., NYBORG, W. L., PIELEMEIER, W. A., AND THORPE, H. A. *J. Acoust. Soc. Amer.*, **19**, 222–34 (*Jan.*, 1947).—Gives results of studies in atmospheric ultrasonics in unforested areas in the tropics and in the temperate zone. Fundamental propagation phenomena were investigated and their causes isolated through correlations with simultaneously observed micro-meteorological phenomena. At times the open air is a scattering, as well as absorbing, medium. Values of absorption coefficients are presented for frequencies up to 30 kc/s. A.

534.222.1 : 551.508 1766

Calculation of sound rays in the atmosphere. ROTHWELL, P. *J. Acoust. Soc. Amer.*, **19**, 205–21 (*Jan.*, 1947).—Earlier methods of calculating the effect of wind and temp. are simplified by using a number of tables. Preparation of the tables from atmospheric data is described, and examples given of their use to trace sound rays in ideal and other atmospheric structures. The method may be of value in meteorological investigations by acoustic methods. G. F. H.

534.222.2 176

Theory of the propagation of shock waves. BRINKLE S. R., JR., AND KIRKWOOD, J. G. *Phys. Rev.*, **71**, 606–1 (*May* 1, 1947).—An extra relation is set up by imposin a similarity restraint on the shape of the energy tim curve of the shock wave and by utilizing the second la of thermodynamics to determine, at an arbitrary distanc the distribution of the initial energy input betwee dissipated energy residual in the fluid already traverse by the shock wave and energy available for furth propagation. The theory takes proper account of th finite entropy increment of the fluid produced by th passage of the shock, and permits the use of the exa Hugoniot curve of the fluid in the numerical integratio of the basic equations. A

534.222.2 : 533.6.011.5 *see Abstr.* 1752

534.231.1 176

Acoustic wave fronts from a "piston" source. WI LIAMS, A. O., JR. *J. Acoust. Soc. Amer.*, **19**, 156–6 (*Jan.*, 1947).—Some properties are deduced from a approx. expression for the velocity potential. Th calculations are limited to frequencies and dimensions c interest in supersonics. The results comprise, for plan pistons, (*a*) a determination of the place where the wav fronts reverse their curvature from converging to divergin shape; (*b*) a calculation of the radius of curvature of th fronts at moderately large distances from the source (*c*) an approx. theoretical equation for their shape. A

534.232 176

Two parabolic reflector underwater transducers. REITZ J. R., AND MUESER, R. E. *J. Acoust. Soc. Amer.*, 19 35–43 (*Jan.*, 1947).—A line source underwater transduce may be used in conjunction with a parabolic cylinde reflector to produce a highly directive sound ray simila to that obtained from a shaded plane source. Poo patterns result from the construction of a unit where th element is at the focus of a parabolic cylinder reflecto because the finite size of the element is so great as t block many of the reflected sound rays. To overcom this difficulty an ideal surface is derived which permit the line source to be placed out of the direct path of th reflected rays. This derivation and the construction an acoustic characteristic of the consequent transducer ar discussed. A

534.232 = 82 177

On the stability of transducers. KHARKEVITCH, A. A *J. Tech. Phys., USSR*, **16** (*No.* 7) 851–6 (1946) *In Russia* —Systems with 2 degrees of freedom are considere generally, and their characteristic differential equation are formulated. The electrostatic, moving-iron electro magnetic, piezo-electric, magnetostriction and thermo mechanical transducers are treated. As an example th method is applied to two specific quartz and Rochell salt transducers; it is shown that they possess nearl maximum possible efficiency. A. I

534.232 : 534.612 : 534.321.9 177

High intensity ultrasonics: the power output of a piezo electric quartz crystal. EPSTEIN, L. F., ANDERSEN W. M. A., AND HARDEN, L. R. *J. Acoust. Soc. Amer* **19**, 248–53 (*Jan.*, 1947).—The max. power density Υ_{ma} experimentally attained $\ll$ the value computed from th electrical and mechanical characteristics of quartz Failure of such systems is attributed to dielectric break down in the surrounding insulating fluid, and a simpl theory is developed in which Υ_{max} is predicted from th value of the dielectric strength. If the breakdown voltag gradient for the medium $(V/d)_{max}$ is independent o thickness, Υ_{max} does not change with frequency; but i

$d)_{max}$ decreases with thickness, Υ_{max} increases with quency, approaching a saturation value as $\nu \to \infty$. output of 43 W/cm² has been achieved at a frequency 1 000 kc/s. The determination of the power output a calorimetric substitution method is described. A.

.24 : 534.321.9 1772

urface reflection of short supersonic pulses in the an. URICK, R. J., AND SAXTON, H. L. *J. Acoust. Soc. er.*, **19**, 8–12 (*Jan.*, 1947).—With a choppy sea, a le pulse emitted by a source 200 ft deep, operating at kc/s, is received by a hydrophone 12 ft deep, as a nplex and continuously variable string of pulses, the t being identified as a reflection from the smooth-face reflection-point. Photographs show that the face reflection is mostly specular. G. F. H.

.25 1773

mage interference in the presence of refraction. YOUNG, W. *J. Acoust. Soc. Amer.*, **19**, 1–7 (*Jan.*, 1947).—derwater sound transmission was studied as a function range at 0·2–22·5 kc/s, under varying thermal con-ions. At 3 lower frequencies, marked interference tterns were observed which result from the combina-n of surface-reflected sound (as from an image source) d directly transmitted sound. Refraction modifies the erference pattern. A formula is developed to predict s influence of refraction on the propagation of sound itted from a point source adjacent to a reflecting plane. eory agrees well with experimental data obtained with source at a depth of 14 ft and the receiver at 300 ft. A.

4.26 1774

Diffraction of sound around a circular disk. PRIMAKOFF, , KLEIN, M. J., KELLER, J. B., AND CARSTENSEN, E. L. *Acoust. Soc. Amer.*, **19**, 132–42 (*Jan.*, 1947).—The und field behind a circular disc, with a point source of und on its axis, is computed approximately. The edictions of the Kirchhoff theory are compared with more accurate calculation using Green's function. he theory is compared with accurate measurements of e sound field, and satisfactory qualitative and quan-ative agreement is found. A.

34.26 1775

On the diffraction of a progressive sound wave by the man head. WIENER, F. M. *J. Acoust. Soc. Amer.*, **19**, 43–6 (*Jan.*, 1947).

34.321.9 = 5 1776

Optics of ultrasonics and ultra-acoustic images. ARBIER, O. *Alta Frequenza*, **11**, 383–96 (*Aug.-Sept.*, 942) *In Italian.*—An apparatus is described to obtain ltrasonic images of objects immersed in a liquid. The onversion from acoustic to optical images is obtained by canning the former with a quartz crystal which modulates ray of light. The frequency employed was 2–3 Mc/s, nd the resolving power is of the order of 1 mm. L. P.

34.321.9 : 533.15 1777

Separation by diffusion in fields of ultrasonic waves. REI, H., AND SCHIFFER, M. *Phys. Rev.*, **71**, 555 (*April* 15, 947).—Separation of homogeneous substances (solutions f glycerine with water, and of hexane with heavier araffins) was observed using 1 Mc/s waves of ~2 W/cm.²

34.321.9 : 532.74 : 534.22.096 = 5 *see Abstr.* 1762–3

34.321.9 : 534.22.096 *see Abstr.* 1761

34.321.9 : 534.222.1 *see Abstr.* 1765

34.321.9 : 534.24 *see Abstr.* 1772

34.321.9 : 534.612 : 534.232 *see Abstr.* 1771

34.321.9 : 534.845 : 534.22.094.1 *see Abstr.* 1760

34.321.9 : 534.845.2 *see Abstr.* 1788

534.321.9 : 538.652 : 534.612 *see Abstr.* 1781

534.414 1778

Investigations on acoustic resonators. SAMULON, H. *J. Acoust. Soc. Amer.*, **19**, 191–3 (*Jan.*, 1947).—Considerations of the energy losses in narrow tubes have led to a study of the sharpness of resonance in acoustic resonators having necks which can be varied in length. Twelve resonators, investigated theoretically and experimentally, lead to an expression for the damping coefficient $\rho_v = 4 \cdot 44 f^{\frac{1}{2}} \cdot D^{-1}$ (f = frequency, c/s; D = dia. of neck, cm). This expression neglects radiation damping and assumes a value of 0·145 for the kinematic viscosity of air at ~ 18°C and 730 mm Hg. A. B. W.

534.417 1779

Measurement conditions influencing the front-to-back discrimination of an underwater hydrophone. MILLER, L. N. *J. Acoust. Soc. Amer.*, **19**, 59–62 (*Jan.*, 1947).

534.6 : 621.395.623.64 1780

Headphone measurements and their interpretation. MARTIN, D. W., AND ANDERSON, L. J. *J. Acoust. Soc. Amer.*, **19**, 63–70 (*Jan.*, 1947).—[Abstr. 1801 B (1947)].

534.612 : 534.321.9 : 534.232 *see Abstr.* 1771

534.612 : 534.321.9 : 538.652 1781

Comparison of supersonic intensities by means of a magnetostriction gauge. SMITH, A. W., AND WEIMER, D. K. *Rev. Sci. Instrum.*, **18**, 188–90 (*March*, 1947).—The gauge consists of a Ni rod wound with 60 turns of wire placed in liquid with its length parallel to the direction of the waves. A 5-mm length is resonant in transformer oil to 570 kc/s, and the inverse magneto-striction effect provides an output of a few mV. The disturbance to the acoustic field produced by the gauge < that of a quartz plate gauge, though the output is less, and the measured intensities not absolute.

534.75 : 534.78 *see Abstr.* 1783

534.756 : 612.85 1782

Acoustical quanta and the theory of hearing. GABOR, D. *Nature, Lond.*, **159**, 591–4 (*May* 3, 1947).—The physical and physiological aspects of the author's theory [Abstr. 479 B (1947)] are discussed. An "acoustical quantum" is a signal the product of whose effective duration and effective frequency range ≃ 1 (with appropriate units), and it is shown that over a substantial range the ear has a threshold discrimination of ~1 quantum. This implies a second mechanism in the ear, of a hitherto unknown kind.

534.78 : 534.75 1783

Factors governing the intelligibility of speech sounds. FRENCH, N. R., AND STEINBERG, J. C. *J. Acoust. Soc. Amer.*, **19**, 90–119 (*Jan.*, 1947).—The intelligibility of sounds is related to a quantity called *articulation index* computed from the intensities of speech and unwanted sounds received by the ear, both as a function of frequency. Relationships developed for this purpose are presented. Results calculated from them are compared with the results of tests of the subjective effects on intelligibility of varying the intensity of the received speech, altering its normal intensity-frequency relations and adding noise. A.

534.78 : 621.395.813 1784

Effects of distortion on the intelligibility of speech at high altitudes. MILLER, G. A., AND MITCHELL, S. *J. Acoust. Soc. Amer.*, **19**, 120–5 (*Jan.*, 1947).

534.843 = 5 1785

Natural frequencies and decrement in a reverberating enclosure. SACERDOTE, G. *Alta Frequenza*, **16**, 37–46

(*Feb.*, 1947) *In Italian.*—Values are calculated using a series developed from the acoustic admittance of the material covering the walls of a room, four of which are reflecting and one absorbing. The behaviour of a room having one open window was also investigated. A.

534.843 : 612.85 1786

An acoustic constant of enclosed spaces correlatable with their apparent liveness. MAXFIELD, J. P., AND ALBERSHEIM, W. J. *J. Acoust. Soc. Amer.*, **19**, 71–9 (*Jan.*, 1947).—A constant *L* called *liveness* is derived which is correlatable with the acoustic properties of the enclosed space and with the distance between the sound source and the listener. It represents the ratio of a time integral of the energy density of the reverberant sound to the unintegrated energy density of the direct sound, and its validity has been substantiated empirically. *L* represents statistically, a relationship between physical factors fundamental to the process of interpretation of sound by the ear. Therefore, a time integral phenomenon in the ear appears to be a fundamental factor in the interpretation of sound perceptions. A.

534.844.4 1787

Reverberation time nomographs. COILE, R. C. *Electronics*, **20**, 142–4 (*April*, 1947).—Areas of materials in a room are measured and number of absorption units of each material found with the first nomograph. Total absorption units are then combined with room volume on a second nomograph to obtain directly the reverberation time in sec. A.

534.845 : 534.321.9 : 534.22.094.1 *see Abstr.* 1760

534.845.2 : 534.321.9 1788

Absorption of supersonic waves in water near one megacycle. LABAW, L. W., AND WILLIAMS, A. O., JR. *J. Acoust. Soc. Amer.*, **19**, 30–4 (*Jan.*, 1947).—An experiment is described, using a small microphone detector, in an attempt to measure absorption in a divergent supersonic beam by comparison of the measured and theoretical acoustic pressure curves along the beam axis. The results, between 1·09 and 1·30 Mc/s, are negative in that the computed absorption coefficients fall below the experimental error. A fairly reliable upper limit can, however, be set on the coefficient which is consistent with the value predicted by extrapolating the (frequency)^2 relationship down to 1 Mc/s. A.

534.85 1789

A curvature meter for use in disk recording. SEPMEYER, L. W. *J. Acoust. Soc. Amer.*, **19**, 161–4 (*Jan.*, 1947).—The meter whose theory and construction are described monitors the cutting of a record in terms of the curvature of the groove modulation, since the sharpest modulation which can be reproduced is that having a radius slightly >the tip radius of the reproducing stylus. A.

534.85 1790

Wire recorder wow. SEAR, A. W. *J. Acoust. Soc. Amer.*, **19**, 172–8 (*Jan.*, 1947).

534.85 : 621.395.625.2 1791

Resonant circuit modulator for broad band acoustic measurements. HULL, G. F., JR. *J. Appl. Phys.*, **17**, 1066–75 (*Dec.*, 1946).—The output of a resonant LRC circuit is modulated by the mechanical variation of *C* by a sound wave; in this way a broad frequency response, down to ~0 c/s, is obtained for recording. The theory is discussed, and apparatus described.

534.851 1792

Improved theory of the light pattern method for the modulation measurement in groove recording. HORNBOSTEL, J. *J. Acoust. Soc. Amer.*, **19**, 165–9 (*Jan.*, 1947).

534.851 17

Sound embossing at the high frequencies. MORSE, M *J. Acoust. Soc. Amer.*, **19**, 169–72 (*Jan.*, 1947).

534.862.2 : 621.395.613.386 17

Magnetic throat microphones of high sensitivit MARTIN, D. W. *J. Acoust. Soc. Amer.*, **19**, 43–50 (*Ja* 1947).—[Abstr. 1800 B (1947)].

534.862.4 : 621.395.623 17

Experiments in listening. WEBSTER, N. D., AN MCPEAK, F. C. *Electronics*, **20**, 90–9 (*April*, 1947).— Audience reaction to reproduced music, from both li and transcribed sources, is tested with a high-quali audio system. Results of tests and data on the design the stereophonic equipment used are given.

OPTICS . RADIATION . SPECTRA 535

535.11 : 530.12 17

Notes on the Wheeler–Feynman theory. BEREND C. W. *Phys. Rev.*, **71**, 550 (*April* 15, 1947).—Th author's suggested relation between Mach's principle the relativity of inertia, as used in the general theory relativity, and the Wheeler–Feynman theory involvin advanced potentials [Abstr. 733 (1946)] is furthe developed and certain important consequences ar indicated. W. E. L

535.215 : 621.383.2 : 537.312.5 = 82 *see Abstr.* 1865

535.23.08 : 536.24 *see Abstr.* 1851

535.23.08 : 537.311.3 : 621.317.794 179

An investigation of the properties of evaporated meta bolometers. BILLINGS, B. H., HYDE, W. L., AND BARR E. E. *J. Opt. Soc. Amer.*, **37**, 123–32 (*March*, 1947).— [Abstr. 1716 B (1947)].

535.232.08 179

A method for measuring the spectral energy distributio of low brightness light sources. STUDER, F. J. *J. Opt Soc. Amer.*, **37**, 288–91 (*April*, 1947).—A standar spectrometer is used in conjunction with a photo multiplier tube for surfaces whose brightness is only few footlamberts. Relative energy is found by direc comparison with a W lamp calibrated for colour tem perature. Results obtained for various fluorescent lamp agree well with measurements made on a large doubl monochromator. A

535.242.4 179

A "tangent-law" photometer. YARNOLD, G. D. *Phil Mag.*, **37**, 534–7 (*Aug.*, 1946).—An unconventiona photometer is described, the advantages being (1) a lon optical bench is unnecessary, (2) the photometer head remains fixed, (3) comparisons of extended sources ar easily made. It consists of a small white plaster cub mounted on a turntable, whose axis of rotation coincide with one edge, *E*, of the cube. Each of the faces, A_1 an A_2, which intersect in *E*, are illuminated by light from one source only, and the turntable is rotated until the illuminations are made equal at the corner. L. S. G

535.243 : 535.343.08 180

An automatic recording spectrophotometer. COOR, T. JR., AND SMITH, D. C. *Rev. Sci. Instrum.*, **18**, 173–83 (*March*, 1947).

535.243 : 545.822 : 621.383.2 1801

The measurement of the intensity ratios of spectral lines with electron multiplier photo-tubes. KESSLER, K. G., AND WOLFE, R. A. *J. Opt. Soc. Amer.*, **37**, 133–44 (*March*, 1947).—Some properties of these tubes, and their use in quantitative spectrographic analysis, are discussed, and a scheme for reducing the effect of the dark current is described. A sharply tuned electronic filter passing only

120 c/s component of the signal is used to increase signal/noise ratio. An amplifier circuit for measuring nsity ratios is shown, and results from its application he analysis of Cr in steel are tabulated. A.

.243 : 621.317.311 = 5 1802

ligh-sensitivity current detector and colour-temperature ısurements. GARELLI, C. M. *Ric. Sci.*, **13**, 407–9 g.–*Sept.*, 1942) *In Italian.*—Apparatus is described, ed on the compensation principle [Abstr. 144 (1904)], current from a photocell being used to charge a acitor of known capacitance. The instrument was d in connection with spectrophotometric measure- nts to measure currents of $\sim 10^{-14}$ A. Relative or 1%. J. A. W.

:.243–15 1803

A double-beam, percent transmission recording infra-red ctrophotometer. WRIGHT, N., AND HERSCHER, L. W. *Opt. Soc. Amer.*, **37**, 211–16 (*March*, 1947).—A rock- t prism spectrometer equipped with a fast responding ometer is used. Two radiation beams from the same ırce are made to fall alternately (at 6 c/s) upon the slit the spectrometer while a variable diaphragm auto- tically balances one of the beams against the other. ctronic amplification and pen-type recording are ployed to register the spectra, which appear directly % of radiation transmitted. Differential comparison two samples, one placed in each beam, is an important pability of the instrument. A.

5.247 : 621.317.6 : 621.327.43 1804

The measurement of fluorescent lamps and luminaires. TTLE, W. F., AND SALTER, E. H. *Illum. Engng, N.Y.*, , 217–33 (*Feb.*, 1947).—[Abstr. 1733 B (1947)].

5.313.6 : 535.87 1805

Apparatus for determining spherical aberration of nvex surface of paraboloid of revolution. GOLDBERG, B., ND BENSON, N. C. *J. Opt. Soc. Amer.*, **37**, 186–91 *Aarch*, 1947).—The apparatus was developed for testing oulds used for electroforming 60-in searchlight re- ctors. A narrow beam parallel to the axis diverges, ter reflection, from the virtual image, and is reflected by small plane mirror parallel to the axis so as to strike a otographic plate placed at the anti-focus. The echanism for exploration of the surface by movement collimator and mirror is described.

35.317 1806

Note on aplanatic lenses for unit magnification. SMITH, . *Proc. Phys. Soc., Lond.*, **59**, 323–5 (*March*, 1947).— formal solution is given for the construction of thin mmetrical cement triple objectives corrected for unit agnification. Corresponding to any symmetrical jective with a diverging lens between two converging nses there corresponds another with a converging etween two diverging lenses, and with the same kind of lass for the exterior lenses the curvatures and glass roperties for the central lens of one objective can be ritten down when those of the other objective are nown. Both objectives are free from coma and have ne same amounts of chromatic and spherical aberrations. A.

35.317.3 : 535.32 = 4 *see Abstr.* 1807

35.32 : 535.317.3 = 4 1807

Dispersion and achromatism. DURAND, É. *Ann. Phys., aris* (*Sér.* 11) **20**, 535–44 (*Sept.–Oct.*, 1945) *In French.*— dispersion formula based upon consideration of fringes ormed by light of different frequencies. For dispersive nedia one must employ the phase velocity. The con- lition for achromatism derives from the condition that ght emitted at a given moment by the source shall arrive simultaneously at the focus. A number of examples are treated, and it is claimed that the method unifies the study of dispersive and achromatic systems. H. H. HOP.

535.321 : 535.39 : 535.514.2 1808

Polarimetric methods for the determination of the refractive index and the thickness of thin films on glass. VAŠIČEK; A. *J. Opt. Soc. Amer.*, **37**, 145–53 (*March*, 1947).—A general method and various modifications are developed for the determination from polarimetric measurements of the reflected light, using plane polarized incident light. The mathematical problem involved cannot be solved in explicit form but, as shown by numerical examples, exact results can be obtained by graphical interpolation. A.

535.321 : 535.415 1809

Determination of refractive index of a liquid by Newton's rings. WOOLLEY, R. L., AND SEARLE, G. F. C. *Phil. Mag.*, **37**, 728–32 (*Oct.*, 1946).—The method is carefully described and a practical example is given to show the type of result obtainable in about ½ hour. L. S. G.

535.323 : 535.39 1810

The infra-red refractive index and dispersion of evaporated stibnite films. BILLINGS, B. H., AND HYMAN, M., JR. *J. Opt. Soc. Amer.*, **37**, 119–21 (*Feb.*); *errata*, 395 (*June*, 1947).—The value 2·43 was obtained at 10 μ by transmission measurements on a film on an AgCl plate. The value 2·5 at 10 μ was obtained by extrapolating the dispersion curve of a film on NaCl from a point in the visible spectrum where the refr. index was known by Brewster's angle measurements. A.

535.323 : 539.39 *see Abstr.* 1810

535.33 : 523.87 1811

The calculation of line strengths from laboratory data. PETRIE, W. *Canad. J. Res.*, *A*, **25**, 42–8 (*Jan.*, 1947).—A. S. King has made extensive intensity estimates of spectral lines in furnace and arc spectra, and these data provide useful material for determining line strengths. The estimates have been made for many elements of astrophysical interest, and are reduced to line strengths for Fe I, Ti I, and Ti II. A.

535.33 : 537.531 *see Abstr.* 1873–4

535.33.03 1812

A spectroscopic study of an uncondensed spark between copper electrodes in three different gases at various pressures. JAGDEO SINGH AND SREE RAMULU. *Indian J. Phys.*, **19**, 235–42 (*Dec.*, 1945).

535.33.071–15 1813

An infra-red prism spectrometer of high resolving power. NIELSEN, J. R., CRAWFORD, F. W., AND SMITH, D. C. *J. Opt. Soc. Amer.*, **37**, 296–301 (*April*, 1947).—An infra-red spectrometer employing interchangeable 60°-prisms with faces 10×15 cm of KBr, NaCl, and LiF in Wadsworth-Littrow mounting is described. A.

535.33.072–14 : 537.569.4 1814

Microwave spectrograph. HUGHES, R. H., AND WILSON, E. B., JR. *Phys. Rev.*, **71**, 562–3 (*April* 15, 1947).—Absorption by gas in a waveguide is detected more sensitively by applying a lateral "Stark effect" field alternating at a r.f. to which the receiver intermediate amplifier is tuned. If the microwave frequency is slowly swept through a range, an absorption band is marked by the appearance of r.f. modulation of the received signal due to the variation of the Stark effect.

535.333–15 : 548 : 535.375.5 *see Abstr.* 1833

535.338.332 1815

Fine structure of H_α. GIULOTTO, L. *Phys. Rev.*, **71**, 562 (*April* 15, 1947).—The separation of the apparent H_α doublet is found to be $0{\cdot}310 \pm 0{\cdot}007$ cm^{-1}, still in disagreement with the theoretical separation of $0{\cdot}327$ cm^{-1} of the "reconstructed" doublet. [See Abstr. 4933 (1938)]. W. E. D.

535.338.334 : 523.874 *see Abstr.* 1711

535.338.4 : 536.46 1816

The emission spectrum of glyoxal. GAYDON, A. G. *Trans. Faraday Soc.*, **43**, 36–41 (*Jan.–Feb.*, 1947).—A Tesla discharge through flowing glyoxal vapour gives a spectrum in the blue-green which is related to the fluorescence spectrum and absorption spectrum of this molecule. Differences between the present author's wavelengths of emission and absorption bands and those obtained in fluorescence and absorption by Thompson [Abstr. 2803 (1940)] are discussed. The observations can be explained satisfactorily by assuming that the glyoxal molecule has the planar "trans" form, and fundamental frequencies adequate to explain the results are given. The flame spectrum of glyoxal has been examined. A.

535.338.4 = 4 1817

Spectroscopic study of the luminescence resulting from a silent discharge [effluve] in nitrogen. JANIN, J. *Ann. Phys., Paris* (*Sér.* 12) **1**, 538–606 (*Sept.–Oct.*, 1946) *In French.*—Electrodeless discharges of the ozonizer type through N_2 have been examined. The Vegard–Kaplan bands occur strongly, and rotational analyses of several are given. The type of discharge favours forbidden transitions; the line ^4S–^2P of N I at 3 466 Å, and the $^1D_2$–$^1S_0$ auroral line of O I are obtained. In the presence of A the vibrational intensity distribution in the First and Second Positive system of N_2 is abnormal. The mechanism of excitation is discussed; molecular impacts are important. In electrodeless discharges at low pressure, two new systems of N_2 due to transitions from levels at 104 709 and 104 327·8 cm^{-1} to $a^1\Pi$, also reported by Gaydon and Herman [Abstr. 1853 (1946)] are obtained and analysed. Some additional weak band-heads associated with the Second Positive system are probably due to $^PQ_{12}$ satellite branches. A. G. G.

535.34 : 537.531 *see Abstr.* 1875

535.341–15 : 541.57 1818

The experimental determination of the intensities of infra-red absorption bands. II. Measurements on ethylene and nitrous oxide. THORNDIKE, A. M., WELLS, A. J., AND WILSON, E. B., JR. *J. Chem. Phys.*, **15**, 157–65 (*April*, 1947).—[For I, see Abstr. 592 (1947)]. The absolute intensities $\times 10^{-10}$ have been determined experimentally to be (in cycles/cm at N.T.P.):—Ethylene: 950 cm^{-1}, 1 540; 1 444 cm^{-1}, 210; 3 050^{-1}, 840. Nitrous oxide: 590 cm^{-1}, 120; 1 285 cm^{-1}, 1 150; 2 224 cm^{-1}, 5 600. The dipole moments, μ, of bonds between vibrating atoms, are all deduced to be $\sim 0{\cdot}5 \times 10^{-18}$ c.g.s. units, and $\partial\mu/\partial r \simeq 10^{-10}$ c.g.s. units (r = internuclear distance). These agree with available data within estimated 10% experimental error. A.

535.342 : 539.11 : 536.212 : 538.224 : 537.311.33 *see Abstr.* 1864

535.343.08 : 535.243 *see Abstr.* 1800

535.343.2–15 : 666.246.3 1819

Infrared absorption spectra of some experimental glasses containing rare earth and other oxides. STAIR, R., AND FAICK, C. A. *J. Res. Nat. Bur. Stand. Wash.*, **38**, 95–101 (*Jan.*, 1947).

535.343.3 = 5 182

Contribution to the technique of measuring absorptio spectra of liquids and solutions. MILAZZO, G. *Ric. Sci* **13**, 181–5 (*April–May*, 1942) *In Italian.*—Current photc graphic and photo-electric methods and apparatus ar critically reviewed, including the Spekker photomete and the use of a rotating sector to ensure uniforr illumination. An instrument is described in detail, i which a metal wire grid on a rotating disc is substitute for the sector. Results of measurements on a wea alkaline solution of picric ion are given, showing probable error of 0–5%. J. A. W

535.343.4 = 4 182

Infra-red spectra of methyl halides. II. Fundament vibrations of partially deuterated halides (Radical CH_2 CHD_2). COURTOY, C. *Ann. Soc. Sci., Brux.* (*Sér.* 1) 6 (*No.* 1) 55–65 (1947) *In French.*—For I, see Abstr. 82 (1947).

535.343.4–14 182

Absorption of methyl alcohol and methylamine fo 1·25 cm waves. HERSHBERGER, W. D., AND TURKEVICH, J *Phys. Rev.*, **71**, 554 (*April* 15, 1947).

535.343.4–14 : 538.569.4 182

The absorption of microwaves by uncondensed wate vapor. VAN VLECK, J. H. *Phys. Rev.*, **71**, 425–33 (*April* 1 1947).—The absorption due to uncondensed water vapou in the short microwave region is computed by means o quantum mechanics. The attenuation is attributed to tw causes: (*a*) a single line $\lambda = 1{\cdot}35$ cm, $\sim 0{\cdot}2$ db/km pe gram of H_2O/m^3, and (*b*) the combined residual effec of all the other lines, whose wavelengths are too shor for resonance. The absorption caused by (*b*) $\propto 1/\lambda^2$. The theory is compared with existing microwave data On the whole the theory and experiment agree satis factorily, except that the attenuation due to the residua effect (*b*) is apparently about 4× predicted. Possibl causes are speculated upon. Finally a curve is include of the predicted absorption in the millimeter region where water vapour is much more opaque than at centi metre wavelengths, and new resonances come into play. A

535.343.4–14 : 538.569.4 182

The absorption of microwaves by oxygen. VAN VLECK J. H. *Phys. Rev.*, **71**, 413–24 (*April* 1, 1947).—Ever though electrically non-polar, O_2 absorbs microwave because the magnetic moment of the O_2 molecule inter acts with electromagnetic fields. The resulting absorptior is most pronounced, exceeding 10 db/km, for wavelength in the vicinity of ½ cm; there is also a subsidiary resonanc near ¼ cm, and a non-resonant absorption at long wave lengths due to diagonal matrix elements. The calculate values of the absorption are given in a table. Comparisor is made with the ½ cm absorption, observed by variou experimenters. The theoretical dependence of th absorption on pressure is discussed. A

535.343.4–14 : 538.569.4 182

Expected microwave absorption coefficients of water an related molecules. KING, G. W., HAINER, R. M., AN CROSS, P. C. *Phys. Rev.*, **71**, 433–43 (*April* 1, 1947).— The line strengths of all transitions of H_2O up to $J =$ have been calculated exactly and the transformatior matrices are given explicitly. The microwave absorptior of HDO and D_2O is also predicted with the use of th dipole moment and half-width of H_2O which are pre sumably the same in the isotopic molecules. In addition it is pointed out that HDO has components along both the least and intermediate axes of inertia, so that lines o HDO should appear throughout the radio and microwave regions. One of these lines has been discovered a $0{\cdot}7441$ cm^{-1}. The microwave absorption of H_2S and

Se is discussed, and it is pointed out that HDS and DSe will also have many lines in this region. A.

5.345.6 : 535.39 1826

High transmission windows for radiation of 3 to 14 crons wave-length. HYMAN, M., JR., AND BILLINGS, H. *J. Opt. Soc. Amer.*, **37**, 113–18 (*Feb.*, 1947).—ver chloride windows for the transmission of infra-red ve been protected against photochemical decomposition coating with evaporated stibnite. They have, further, en rendered high-transmitting by coating with various astics. [See Abstr. 1810 (1947)]. A.

5.347 : 535.514.2 *see Abstr.* 1845

5.37 : 577.15.035 = 3 1827

Energy transference and fluorescence. FÖRSTER, T. *aturwiss.*, **33**, 166–75 (*Sept.* 30, 1946) *In German.*—milarities between processes of energy transference, llowing light absorption, in photo-biological systems d in non-biological fluorescent dye solutions are noted. fects of concentration on polarization and quenching fluorescence in the latter are discussed, and possible ocesses of transference of absorbed energy outlined. heir application to the assimilation of light energy by ological materials is considered. C. C.

5.371 1828

The brightness of apparent fluorescence as a function of e exciting intensities. URBACH, F., URBACH, A., AND CHWARTZ, M. *J. Opt. Soc. Amer.*, **37**, 122 (*Feb.*, 947).—Rapid variation of fluorescence efficiency with citing intensity has been observed at low intensities of citation, or at high temperatures or with "poisoned" osphors. The effects of poisons and temperature on ficiency are often dependent on intensity of excitation.

35.371 1829

Some new aspects of germanate and fluoride phosphors. VILLIAMS, F. E. *J. Opt. Soc. Amer.*, **37**, 302–7 (*April*, 947).—By crystallizing with excess MgO the photo-minescent efficiency of Mn-activated Mg ortho-ermanate has been increased 500%. The emission pectra of these materials extend from 6 100–6 700 Å, nd exhibit a unique fine structure consisting of 4 bands ~50 Å wide and having peaks ~90 Å apart. Mn-ctivated (Zn, Mg)F_2 phosphors exhibit under cathode-ay excitation longer truly-exponential afterglow than ny known luminescent material. Crystallization under 00 atm. of HF does not greatly alter their luminescent haracteristics. Fluoride phosphors, particularly Mn-ctivated ZnF_2, can be evaporated and condensed in a acuum to form thin uniform transparent layers without nduly affecting the luminescent efficiency. A.

35.371 1830

Note on the stability of phosphors under ultraviolet radiation. FROELICH, H. C. *J. Opt. Soc. Amer.*, **37**, 08 (*April*, 1947).

35.371 1831

Fluorescence of tungstates and molybdates. KRÖGER, A. *Nature, Lond.*, **159**, 674–5 (*May* 17, 1947).—ungstates and molybdates of many metals (e.g. Cd, Ba, b, Li, Na) were found to fluoresce under u.v. excitation t sufficiently low temperatures down to −180°C. raphs showing the quenching temperatures are given.

35.375.5 1832

Applicability of the Placzek's theory of Raman scattering t high temperatures. VENKATESWARLU, K. *Curr. Sci.*, **16**, 15–16 (*Jan.*, 1947).—A note giving a résumé, without experimental detail, of the author's findings on the variation of intensity of Stokes and anti-Stokes Raman lines with temperature, explaining divergences from expected behaviour as due to the inadmissibility, at high temperatures and consequently large vibration amplitudes, of an approximation in the application of Placzek's polarizability theory. L. A. W.

535.375.5 : 535.333–15 : 548 1833

Selection rules for ionic crystals. COUTURE, L. *J. Chem. Phys.*, **15**, 153 (*March*, 1947).—Illustrations are given which show that Halford's selection rules [Abstr. 1295 (1946)] for Raman spectra are inapplicable to ionic crystals.

535.375.5 : 539.132 1834

The Raman spectra of the compounds $CHCl_2 . CH_2Cl$, $CCl_3 . CH_2Cl$, C_2Cl_6 and $CHCl_2 . CCl_2 . CHCl_2$. GERDING, H., AND HARING, H. G. *Rec. Trav. Chim. Pays-Bas*, **65**, 743–50 (*Oct.–Nov.*, 1946).—Raman frequencies are determined for the liquids (C_2Cl_6 molten at about 200°C). Degrees of depolarization are indicated roughly for the first three compounds and measured more exactly for the fourth. The characteristic CH_2 vibrations in $CCl_3 . CH_2Cl$ are determined, and it is found that for $CHCl_2 . CH_2Cl$ the characteristic vibrations of CH and CH_2 can be distinguished. The results indicate that the molecule $CHCl_2 . CCl_2 . CHCl_2$ probably has the symmetry C_{2v}. The probable symmetry of C_2Cl_6 is D_{3d} and it is concluded that the two halves of this molecule perform torsional vibrations at the temperature of the experiments, thus causing a number of otherwise forbidden frequencies to appear in the Raman spectrum. L. A. W.

535.375.5 : 548.0 1835

Origin of low frequency Raman lines in organic crystals. KASTLER, A., AND ROUSSET, A. *Phys. Rev.*, **71**, 455–6 (*April* 1, 1947).—A brief summary of the work on the subject and of the explanations put forward. W. B. D.

535.375.5 : 548.7 = 4 1836

Vibrational spectra of ionic single crystals. COUTURE, L. *Ann. Phys., Paris* (*Sér.* 12) **2**, 5–94 (*Jan.–Feb.*, 1947) *In French.*—An extensive theoretical treatment of the author's measurements of relative intensities and degrees of depolarization of Raman lines of seven ionic single crystals of compounds containing either $CO_3^=$, NO_3^- or $SO_4^=$. To a single frequency, either simple or degenerate, of the free anion corresponds a group of frequencies of the crystal. Consideration of the symmetry types and relative frequencies and intensities within a group indicates in general a lowering of the symmetry of the anion in the crystal as compared with the free state. Removal of degeneracy of frequencies of the free ion gives rise to frequency displacements greater than those arising from the effect of the interaction of the ions in the lattice upon a non-degenerate frequency. Degenerate valency vibrations are more perturbed in the crystal than deformation vibrations. In addition to the internal vibrations of the polyatomic ions, the spectra show external lattice vibrations which correspond to libration of the anions or mutual displacement of the ions in the solid. For the nitrate and carbonate crystals, unlike the sulphates, some of these lattice frequencies are of high intensity. L. A. W.

535.39 1837

A theoretical development of exact solution of reflectance of multiple layer optical coatings. CABALLERO, D. L. *J. Opt. Soc. Amer.*, **37**, 176–80 (*March*, 1947).—A simple method is developed for the case of normal incidence. The derivation is based upon a vectorial representation of the reflectance of a single or more coating layers, found by a summation of the infinite series of multiple reflections within each layer. Presence of absorption and dispersion may be allowed for in the formulae. A.

535.39 : 535.345.6 *see Abstr.* 1826

535.39.08 = 4 1838

Graphical method for the rapid determination of phase changes occurring on reflection at compound plates. PERROT, M., AND COTTON, P. *Ann. Phys., Paris* (*Sér.* 11) **20**, 585–600 (*Nov.–Dec.*, 1945) *In French.*—The phase changes occurring on normal reflection of a light wave at the surfaces of a layer separating two transparent media are investigated theoretically. Based on the relations for the complex amplitudes for the reflected waves given by Rouard [Abstr. 2088 (1937)] a simple graphical method is described which permits the variation of the phase changes with thickness of the layer to be determined rapidly. The dependence of the phase changes on the optical constants of the layer is obtained and discussed. An interpretation is given for several curious results obtained in experiments by Rouard on thin metallic films deposited on a transparent support. S. W.

535.41 : 535.543 1839

Haidinger's rings in divergent light. RAMACHANDRAN, G. N. *Phil. Mag.*, **37**, 700–6 (*Oct.*, 1946).—The theory of the rings is developed by taking the path retardation of the various rays which contribute to the intensity at the point of observation. The interference fringes are non-localized, and are visible on a screen at any point. Deviations occurring in the path are negligible for angles of incidence near 90° and 0°, so that with the Lummer–Gehrcke and the Fabry–Perot interferometers and a point source, sharp fringes are visible at a sufficient distance. Extension of the theory to birefringent plates is indicated. L. S. G.

535.412 1840

Multiple-beam localized fringes: Part I.—Intensity distribution and localization. BROSSEL, J. *Proc. Phys. Soc., Lond.*, **59**, 224–34 (*March*, 1947).—The interference taking place when a parallel beam of light is incident on a wedge with highly reflecting surfaces is studied theoretically. There is an infinity of planes where clearly resolved fringes are observed even at distances up to several metres from the interferometer. In most cases the spacing of the maxima is a sub-multiple of that given by the classical formula $N\lambda = 2t\cos\theta$, but if minor details are taken into account the fringe period is the same in all planes of localization. All the effects have been experimentally observed. The significance of two fringe-broadening terms in the analysis is explained with reference to practical cases and the importance of small gaps is stressed. A.

535.412 1841

Multiple-beam localized fringes: Part II.—Conditions of observation and formation of ghosts. BROSSEL, J. *Proc. Phys. Soc., Lond.*, **59**, 235–42 (*March*, 1947).—Factors which tend to reduce the perfection of the fringes exist in the optical systems associated with a Fizeau multiple-beam interferometer and in its complexity of surface detail. A parallel is drawn with Abbe's theory of microscope image-formation. Experiments are described showing the effect of diaphragms in the second focal plane of the objective and also in contact with the objective. If the objective has insufficient aperture the fringes broaden and secondary maxima appear. It is shown that the interferometer gap must be > a few wavelengths if the localized fringes are to follow the contour lines correctly over the smallest surface details. The ghosts due to the parasitic reflected light from the many glass-air surfaces of the optical train are described. A.

535.415 : 535.321 *see Abstr.* 1809

535.42 = 4 1842

Remarks on diffraction phenomena. DUFFIEUX, P. M. *Ann. Phys., Paris* (*Sér.* 12) **2**, 95–132 (*Jan.–Feb.*, 1947) *In French.*—The use of Huygens' principle in considering the diffraction of light by opaque bodies is claimed to conflict with the conservation of energy. In comparing the diffraction equations with those associated with corpuscular radiation, it is seen that the vectors used are analogous to those of impulses in the latter case. A discussion of the experimental production of e.m. waves leads to a distinction between two types of coherence. In the Hertzian domain, the characteristic frequency of the wave is determined statistically, while in the case of light one can associate absolute coherence with each quantum. H. H. HOP

535.421 = 5 1843

The "total transmission" of gratings. DI FRANCIA, G. T. *Ric. Sci.*, **13**, 490 (*Aug.–Sept.*, 1942) *In Italian.*—Spectrophotometric measurements on a h.f. diffraction grating have shown that the intensity of the transmitted spectrum nearly doubles when the reflected spectrum vanishes, a phenomenon of total transmission analogous to total reflection, at the boundary of two media of different refractive index. J. A. W.

535.421 : 535.8 = 4 1844

Image of a coherently illuminated slit. DUFFIEUX, M. A., TIRONFLET, J., GUENOCHE, H., AND LANSRAUX, G. *Ann. Phys., Paris* (*Sér.* 11) **19**, 355–95 (*Oct.–Dec.*, 1944) *In French.*—The intensity function in the image of a slit formed by an objective is considered, the results later being extended to the case of two rectangular slits. The slit is considered to be illuminated by a plane wave. A series of photographs of slit-images is given, and the theoretical intensity curves are discussed at length. H. H. HOP.

535.43 : 537.531 *see Abstr.* 1876

535.43 : 539.26 : 539.215.4 : 537.531 *see Abstr.* 1877–8

535.514.2 : 535.347 1845

Polarization of infra-red radiation. ELLIOTT, A., AND AMBROSE, E. J. *Nature, Lond.*, **159**, 641–2 (*May* 10, 1947).—Polarized beams of wavelength up to 7 μ can be obtained by transmission through 3 or more thin free-surface Se films at the appropriate angles. Infra-red pleochroism has been investigated in naphthalene and nylon, to determine how absorption depends on the orientation of the molecule with respect to the direction of vibration of the radiation.

535.514.2 : 535.39 : 535.321 *see Abstr.* 1808

535.543 : 535.41 *see Abstr.* 1839

535.59 : 535.514.2 : 535.321 *see Abstr.* 1808

535.733.5 1846

Notes on W. S. Stiles' paper entitled, "A modified Helmholtz line-element in brightness-colour space." SILBERSTEIN, L. *J. Opt. Soc. Amer.*, **37**, 292–5 (*April*, 1947).—[See Abstr. 766 (1946)].

535.8 1847

A new calculus for the treatment of optical systems. V. A more general formulation, and description of another calculus. JONES, R. C. *J. Opt. Soc. Amer.*, **37**, 107–10 (*Feb.*, 1947).—After a brief review of the nature of the calculus [Abstr. 3030 (1942)] a formulation is provided for its application to a wider class of optical systems. This is found, however, to be subject to the drastic limitation that the system must not depolarize the light passing through it. A more powerful calculus free of this limitation [see Abstr. 2860 (1942)] is described. A.

535.8 1848

A new calculus for the treatment of optical systems. VI. Experimental determination of the matrix. JONES,

C. *J. Opt. Soc. Amer.*, **37**, 110–12 (*Feb.*, 1947).—simple, straightforward method is described for termining experimentally the matrix of any crystalline ate. The method involves three measurements of the ate of polarization of light transmitted by the plate, d also a measurement of its transmission factor for tural light. These measurements determine the matrix iquely, except for a phase factor whose practical nificance is small. The conditions are stated for the plication of the method to the more general type of tical system described in V. [Abstr. 1847 (1947)]. A.

535.8 : 535.421 = 4 *see Abstr.* 1844

535.87 : 535.313.6 *see Abstr.* 1805

HEAT 536

536.2.08 : 621.365.5 1849

Temperature charts for induction and constant-temperature heating. HEISLER, M. P. *Trans. Amer. Soc. Mech. Engrs*, **69**, 227–36 (*April*, 1947).—[Abstr. 59 B (1947)].

536.21 = 3 1850

The heating of an infinite body through a continuously acting source of heat. I–III. ROTT, N. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 164–74 (*June*); 212–16 (*July*, 1945) *German.*—In I a homogeneous rod of constant cross-section is heated by a point source of heat. The equation governing the distribution of temperature (T) is

$$\partial T/\partial t = a\partial^2 T/\partial x^2 - bT,$$

and this is solved both for the stationary state ($\partial T/\partial t \equiv 0$) and the non-stationary state. The solution is given firstly in the case when the source of heat only acts for a very short time, and the result is then extended to a continuous source. In II similar problems in two dimensions are treated, and in III the temperature distribution in a plate heated by a point source moving with uniform velocity is found. L. S. G.

536.212 : 538.224 : 535.342 : 539.11 : 537.311.33 *see Abstr.* 1864

536.24 : 535.23.08 1851

Heating and cooling of bolometer elements. SHIVE, N. *J. Appl. Phys.*, **18**, 398–405 (*April*, 1947).—The analogy between thermal and electrical networks is used to solve problems of the heating and cooling of air-backed and solid-backed bolometer elements exposed to radiation of periodically fluctuating intensity. From the equations derived, thermal response-frequency characteristics are computed for "typical" bolometer elements. Features of these characteristics are discussed, and the physical influences of the thermal properties of the bolometer material and of the backing material are pointed out. A.

536.241 1852

Transient temperatures around heating pipes maintained at constant temperature. GEMANT, A. *J. Appl. Phys.*, **18**, 1076–81 (*Dec.*, 1946).—The theoretical equation is integrated numerically and presented in graphs. The amounts of heat dissipated are also computed and presented. The influence of pipe diameter upon temperatures obtained at given times is shown for a particular case. A.

536.242 1853

The interchange of heat between a gas stream and solid granules. Part I. ARTHUR, J. R., AND LINNETT, J. W. *Chem. Soc.*, 416–24 (*March*, 1947).—The temperature distribution in a bed of charcoal granules through which air is streaming and to which heat is being supplied by a heater embedded in the charcoal has been studied. A mathematical treatment is described which accounts precisely for the results obtained. According to this treatment the rate of interchange of heat between the gas and the solid is proportional to the temperature difference between them, and is rapid compared with the conduction of heat through the charcoal, so that, at the steady state, the temperature of the air follows closely the charcoal temperature at all points. A.

536.244 1854

The determination of thermal lagging times. EVANS, J. C. *Proc. Phys. Soc., Lond.*, **59**, 242–56 (*March*, 1947).—A method for computing the thermal lag of simple and complex bodies of cylindrical form, when the ambient temperature is changing steadily, is given and formulae derived for determining the lagging times of such bodies in liquid and in gaseous media. Calculated values are compared with experimental results. A.

536.422 1855

Effect of shape of operating chamber in the freeze-drying process. EDE, A. J. *Nature, Lond.*, **159**, 610–11 (*May* 3, 1947).—See also Abstr. 611 (1947).

536.423.1 : 539.155.2 *see Abstr.* 1930

536.423.15 1856

Vapor pressure of pure substances. STULL, D. R. *Industr. Engng Chem.*, **39**, 517–50 (*April*, 1947).—Tables are presented giving critically weighted data on over 1 200 organic and 300 inorganic compounds. The data are listed in the form of temperature values for given vapour pressures, and melting and critical points are given where known.

536.423.15 : 531.787 *see Abstr.* 1743–4

536.423.16 = 82 1857

Experiments on the evaporation from the free surface of liquids. CHUDIAKOV, G. N. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 4) 533–41 (1946) *In Russian.*

536.46 : 535.338.4 *see Abstr.* 1816

536.48 : 534.22 *see Abstr.* 1759

536.48 : 548.73 *see Abstr.* 1976

536.483 1858

A helium cryostat. COLLINS, S. C. *Rev. Sci. Instrum.*, **18**, 157–67 (*March*, 1947).—Three expansion devices are described. One is a diaphragm engine having a mechanically supported diaphragm and unusual valves which require no valve gear. The others are piston-cylinder-crankshaft assemblies in which leakage is controlled by extreme close fitting of piston to cylinder, and in which wear of unlubricated surfaces is avoided by constructing the piston and cylinder of nitrided alloy steel and by mounting the piston on a thin flexible piston rod which operates under tension. The piston thereby has enough freedom to permit perfect alignment within the cylinder. A.

536.631 : 539.32 = 4 1859

Variation of the specific heat of rubber as a function of the elongation. MAYOR, A. *Experientia*, **3** (*No.* 1) 26–7 (1947) *In French.*—Non-vulcanized rubber showed no change up to extensions of 300%. Vulcanized rubber showed a small increase, usually proportional to the extension, but some samples showed a knee at ~200%, the variation being 10× greater above the knee; this is probably related to the "heat of crystallization." A.

THERMODYNAMICS 536.7

536.7 : 530.145 1860

On the quantum correction for thermodynamic equilibrium. MAYER, J. E., AND BAND, W. *J. Chem. Phys.*, **15**, 141–9 (*March*, 1947).—Wigner's approximation [Abstr. 4441 (1932)] is unsatisfactory for a system of

many degrees of freedom, that is, one of many dependent molecules. For such a system it is shown that the classical potential U in the exponent may be replaced by $U - kTf$, where f is the same as Wigner's function. A.

536.7 : 532.7 *see Abstr.* 1750

536.71 : 533.75 *see Abstr.* 1754

ELECTRICITY 537

537.122 = 4 1861

On the relations between the densities of mean values deduced from Dirac's wave equation for the electron. PETIAU, G. *C.R. Acad. Sci., Paris*, **222**, 640–2 (*March* 18, 1946) *In French.*—The relations are found by a method previously described [Abstr. 2591 (1946)] and some new relations are obtained. L. S. G.

537.122 : 530.14 = 3 1862

Theory of the electron. WESSEL, W. *Z. Naturforsch.*, **1**, 622–36 (*Nov.–Dec.*, 1946) *In German.*—A classical model with extra degrees of freedom to correspond to the Dirac electron. G. J. K.

537.226 : 548.0 = 3 1863

Investigation on single crystals of barium titanate. BLATTNER, H., MATTHIAS, B., MERZ, W., AND SCHERRER, P. *Experientia*, **3** (*No.* 4) 148–9 (1947) *In German.*—The preparation of single crystals is described. Their ferroelectric properties have been demonstrated as shown by the temperature curve of the permittivity, the resonance frequency and by hysteresis phenomena. A.

ELECTRIC CURRENTS 537.3

537.311.3 : 621.317.794 : 535.23.08 *see Abstr.* 1797

537.311.31 : 538.22 : 539.231 = 4 *see Abstr.* 1972

537.311.33 : 539.11 : 536.212 : 538.224 : 535.342 1864

The band theory of graphite. WALLACE, P. R. *Phys. Rev.*, **71**, 622–34 (*May* 1, 1947).—The structure of the electronic energy bands and Brillouin zones for graphite is developed using the "tight binding" approximation. Graphite is found to be a semi-conductor with zero activation energy, i.e. there are no free electrons at zero temperature, but they are created at higher temperatures by excitation to a band contiguous to the highest one which is normally filled. The electrical conductivity is treated with assumptions about the mean free path. It is found to be about 100× as great parallel to as across crystal planes. A large and anisotropic diamagnetic susceptibility is predicted for the conduction electrons; this is greatest for fields across the layers. The volume optical absorption is accounted for. A.

537.312.5 : 535.215 : 621.383.2 = 82 1865

Complex photo-cathodes. KHLEBNIKOV, N. S. *J. Tech. Phys., USSR*, **16** (*No.* 7) 745–70 (1946) *In Russian.*—A critical investigation and discussion of de Boer's photocathode theory is presented. A novel conception is suggested, based on the semi-conducting nature of complex cathodes, on the spatial character of the external photo-effect and on the difference of the thermo-electron and the photo-electric work function. De Boer's scheme enters the new general theory as a special case. Sb–Cs and Cs–O–Ag cathodes are selected for detailed analysis, and their energy spectrum, ageing and the effect of adsorbed alkali-metal atoms are studied. A bibliography of 47 items is included. A. L.

537.312.62 1866

Conductivity of sodium-ammonia solutions. MACDONALD, D. K. C., MENDELSSOHN, K., AND BIRCH, A. J. *Phys. Rev.*, **71**, 563–4 (*April* 15, 1947).—Under stringent conditions, eliminating the effects of stray magnetic fields, no trace was found of a persistent current as described by Ogg and by Hodgins [Abstr. 1894 (1946) 878 (1947)]. [Note. Fig. 1 is printed in error on p. 558] W. E. D.

537.322 = 3 186

The Thomson effect in metals at high temperatures. PAETOW, H. *Naturwiss.*, **33**, 156–7 (*Sept.* 15, 1946) *In German.*—A method is briefly described by which the sign of the Thomson coeff. of metals at temps. up to the b.pt. can be determined and the magnitude of the effect estimated. Whilst a current is passing between two electrodes in contact they are pulled apart slightly, so that a bridge of molten metal is formed between them. The difference in temp. ~1° between the electrodes is due to the Thomson effect, and is measured with a thermocouple. For all the metals examined, the coeff. becomes negative at a sufficiently high temp., and remains negative up to the b.pt. The magnitudes of the coeffs. were mostly between 10^{-5} and 10^{-4} V/deg. S. W.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.521.7 : 621.315.6 : 621.3.015.5 186

The insulation of high voltages in vacuum. TRUMP, J. G., AND VAN DE GRAAFF, R. J. *J. Appl. Phys.*, **18**, 327–32 (*March*, 1947).—Theories of the electrical breakdown in high vacuum are briefly reviewed, and experiments to elucidate them described. The gradient at the electrodes when breakdown occurs is, for high voltages (100–700 kV), far below the value for field emission, and cumulative release of secondary electrons, positive ions and photons is suggested as a mechanism. Preliminary measurements of some of the coefficients are reported and the importance of their dependence on the electrode material is stressed in connection with the improvement of vacuum insulation methods.

537.523 186

Gas discharge in air of atmospheric pressure at very low voltage. KANTOROWICZ, O. *Nature, Lond.*, **159**, 67 (*May* 17, 1947).—A discharge of small streamers several microns long was observed between two semi-conductor crystals (carborundum) or one crystal and a steel plate when in contact with each other, at potentials as low as 15 V.

537.523.5 : 545.822 187

A note on the effect at the cathode of an arc between copper electrodes. MILBOURN, M. *Proc. Phys. Soc. Lond.*, **59**, 273–4 (*March*, 1947).

537.525 : 538.56 = 3 187

On the theory of electron plasma oscillations. BORGNIS, F. *Helv. Phys. Acta*, **20** (*No.* 2) 207–21 (1947) *In German.*—The theory is discussed from a general standpoint. Langmuir and Tonks treatment [Abstr. 3635 (1929)] needs to be widened to describe the independent appearance of stationary waves in the plasma, whose frequency is in general not identical with the "Langmuir frequency." A.

537.527.5 187

Theory of the high pressure mercury vapour discharge (B). FRANCIS, V. J. *Phil. Mag.*, **37**, 653–76 (*Oct.* 1946).—Previous work [Abstr. 1536 (1947)] is continued and curves relating the important discharge parameters over a wide range of operating conditions are calculated L. S. G.

537.531 : 535.33 1873

Investigations on the structure near the short-wavelength limit of the continous X-ray spectrum. NILSSON, A., AND HULIN, P. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 4) *Paper* 23, 8 *pp.* (1947).—See Abstr. 258 (1945), 636 (1947). The resolving power of the bent-crystal spectrometer was improved by decreasing the focal-spot size by electrostatic and magnetic focusing, by using an indirectly-heated cathode, and by decreasing the slit width, so that the energy spread of the radiation entering the Geiger counter was reduced to 2 volts. Curves of intensity against tube voltage for $\lambda = 3{\cdot}35185$ kX are given for Cr, Fe, Cu, Zn, W, Au and Pb anticathodes. All but Cr show a sharp rise as the critical voltage is reached, a max. 11–14 and a min. 20–24 V above the critical voltage. Pb did not give reproducible results, and no definite max. was found. Au and Fe showed discontinuities of slope in the rising portion of the curves.

A. J. C. W.

537.531 : 535.33 1874

Analysis of high energy X-ray spectra. BALDWIN, G. C., AND KLAIBER, G. S. *Phys. Rev.*, **71**, 554 (*April* 15, 1947). A method is described whereby the energy spectrum of γ-rays can be deduced by measuring only the energy spectrum of the positrons produced in pair production.

W. E. D.

537.531 : 535.34 1875

The *K* X-ray absorption edge of silicon. BARTON, V. P., AND LINDSAY, G. A. *Phys. Rev.*, **71**, 406–8 (*April* 1); *Nature*, 736 (*May* 15, 1947).—The measured value for the edge varied between 6 700 X.U. in quartz, Na silicate and 4 micas, and 6 718 X.U. in Si metal and carborundum. In the former group the Si atom is at the centre of a tetrahedron of O atoms; in the latter these are replaced by Si and C respectively. A.

537.531 : 535.43 1876

Scattering of X-rays of high frequency. WINOGRADOFF, N. *Phil. Mag.*, **37**, 640–3 (*Sept.*, 1946).—For wavelengths up to about 0·10 Å the electronic absorption coefficient, μ, is in good agreement with the value predicted by the Klein–Nishina formula; but for shorter wavelengths the experimental values are much higher. If $\delta(\mu)$ is the difference, it appears that $\delta(\mu) = \alpha - \beta/\lambda$, and this holds for Li, C and Al, but not for Na. There is thus some evidence for a new mechanism of absorption, which is associated with wavelengths ≪ the characteristic radiation of the scatterer, and which cannot be explained by the classical theory. L. S. G.

537.531 : 535.43 : 539.26 : 539.215.4 1877

X-ray scattering at small angles by finely-divided solids. I. General approximate theory and applications. SHULL, C. G., AND ROESS, L. C. *J. Appl. Phys.*, **18**, 295–307 (*March*, 1947).—It is assumed that the X-ray scattering data can be interpreted in terms of a particle size distribution, with particle-to-particle scattering negligible. Scattered intensity curves for Maxwellian, Gaussian, and rectangular size distributions are calculated, and several procedures for obtaining a size distribution from the experimental scattering data are described. Details of the experimental technique are given; appreciable error can result if crystal-monochromated radiation is not used. Scattering data, mass distribution curves, and average particle sizes are presented for amorphous silica gels and for crystalline oxides of Al, Ni and Fe. A.

537.531 : 535.43 : 539.26 : 539.215.4 1878

X-ray scattering at small angles by finely-divided solids. II. Exact theory for random distributions of spheroidal particles. ROESS, L. C., AND SHULL, C. G. *J. Appl. Phys.*, **18**, 308–13 (*March*, 1947).—Families of scattering curves are presented for spheres, and for spheroids ranging in shape from flat discs to long rods. A fit between the experimental and a calculated scattering curve enables one, under favourable circumstances, to determine the mass distribution in the test sample. However, an unambiguous interpretation is not possible without additional evidence from independent investigations of such quantities as particle shape and sample specific surface. A.

537.533.72 1879

The resolving power of a ring-shaped inhomogeneous magnetic field for two-directional focusing of charged particles. SVARTHOLM, N. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 4) *Paper* 24, 10 *pp.* (1947).—The size and the shape of the image formed from a point object by an appropriate magnetic field (Abstr. 2342 (1946), 1880 (1947)], are found from approximate solutions of the equations of motion. The dependence of the image upon the second derivative of the field is discussed. A. P. F.

537.533.72 : 539.165.08 1880

An inhomogeneous ring-shaped magnetic field for two-directional focusing of electrons and its application to β-spectroscopy. SVARTHOLM, N., AND SIEGBAHN, K. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 4) *Paper* 21, 28 *pp.* (1947).—Practical details of design and construction, and the theory underlying the focusing action, are given for a spectrograph already briefly reported elsewhere [Abstr. 2342 (1946)]. A. P. F.

537.533.73 1881

Refraction effects in electron diffraction. COWLEY, J. M., AND REES, A. L. G. *Proc. Phys. Soc., Lond.*, **59**, 287–302 (*March*, 1947).—More detailed observations of the multiple rings given by MgO and CdO smokes [Abstr. 97 (1946)] have been made. General expressions have been derived on the basis of the theory [Abstr. 3042 (1945)] that refraction occurs at the faces of the (cubic) particles, and complete agreement with experiment obtained in particular cases, assuming an inner potential of 12–16 V. Streaks observed with ZnO are ascribed to refraction by long thin spines. A.

537.533.73 1882

Measurements of the relative intensity in electronic Debye–Scherrer diagrams. VON FRIESEN, S., AND LENANDER, S. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 4) *Paper* 20, 16 *pp.* (1947).—Describes experiments designed to test the theoretical formula for the scattering of fast electrons. Electron diffraction photographs of Al foil are taken, the foil used being very carefully prepared so as to be free from preferential orientation. From the intensities of the Debye–Scherrer rings the atomic scattering factor for 20 kV electrons is plotted as a function of $\sin\theta/\lambda$ and it is found that this factor falls off more slowly than is required by theory. This result confirms the work of Ornstein and his collaborators. Certain anomalies found by these workers are stated to have been due to preferential orientation. J. T.

537.533.74 1883

The contribution of restricted rotation to electron scattering by gases. KARLE, J. *J. Chem. Phys.*, **15**, 202–7 (*April*, 1947).—Several formulae have been derived expressing the contribution to the intensity of electron scattering of restricted rotation in the vapours of ethane, ethylene, biphenyl, and their derivatives. The probability distribution of the restricted rotator about its axis of rotation is expressed in terms of the barrier height, V_0. It has, therefore, been possible to evaluate the effect of barriers of known magnitude on scattering patterns. The possibility of evaluating the potential barrier using electron diffraction is discussed. A.

537.533.75 = 4 1884

Range-energy relation of medium- and low-velocity electrons. TSIEN SAN-TSIANG. *Ann. Phys., Paris* (*Sér.* 11) **19**, 327–34 (*July–Sept.*, 1944) *In French.*—Bethe's theory [Abstr. 3811 (1930)] applied to electrons of energy <50 keV agrees well with experiment if 100 eV is taken as the mean excitation potential of the atoms of the air. A.

537.533.8 = 82 1885

Investigation of the energy distribution of secondary electrons emitted by thin dielectric films. ZERNOV, D. V., AND KULVARSKAYA, B. S. *J. Tech. Phys., USSR*, **16** (*No.* 7) 771–82 (1946) *In Russian.*—A special apparatus developed for the investigations is described. An evacuated glass vessel contains three necks housing an electron gun, a molecular gun and a collector system with electron lens. A conducting layer on the inner surface of the vessel acts as an anode for the accelerating potential, and different targets (Ni electrodes) can be moved along an inside rod by magnets. The results of experiments on thin KCl layers are discussed in relation to Fermi's theory. It is shown that apart from secondary emission, "auto-electronic" emission of relatively fast electrons occupying a narrow sector of the energy spectrum near the "Fermi level" also takes place. A. L.

537.534 : 621.384.6 1886

Ion sources for cyclotrons. LIVINGSTON, M. S. *Rev. Mod. Phys.*, **18**, 293–9 (*July*, 1946).—A discussion of ion sources now in use, with an approximate analysis of the form of the initial paths of the ions. The components and operating conditions of several arc sources are described and a scale-drawing of the Carnegie Institution design is given. Resonant beam currents of 300–500 μA are given as customary, with 1 mA as a max. Evidence for space-charge as the controlling limitation of sources is given, and methods of improving yields suggested. J. H. F.

537.534.74 1887

Proton-proton scattering at 14·5 MeV. WILSON, R. R., LOFGREN, E. J., RICHARDSON, J. R., WRIGHT, B. T., AND SHANKLAND, R. S. *Phys. Rev.*, **71**, 560–1 (*April* 15, 1947).—The same conclusions are drawn as those quoted in Abstr. 1543 (1947) for 10 MeV protons. W. E. D.

537.542 : 621.318.572 1888

Geiger–Müller counter characteristics in the Neher–Harper circuit. SIEGBAHN, K. *Ark. Mat. Astr. Fys.*, **33 B** (*No.* 3) *Paper* 7, 5 *pp.* (1947).—Describes the marked influence of the pentode grid potential on the counter characteristic. L. E. M.

537.562 1889

Peak contour and half-life of metastable ions appearing in mass spectra. HIPPLE, J. A. *Phys. Rev.*, **71**, 594–9 (*May* 1, 1947).—A method is described for determining the ½-lives of metastable ions by varying the voltage which sweeps the ions from the ionization chamber of a mass spectrometer. The ½-life of the state corresponding to the transition $C_4H_{10}^+ \rightarrow C_3H_7^+ + [CH_3]$ has been found to be 2 μsec and of $C_4H_{10}^+ \rightarrow C_3H_6^+ + [CH_4]$, 1·7 μsec. The relative number of ions in the metastable states initially is estimated. A.

537.562 = 4 1890

Contribution to the study of phenomena of ionization of gas by radioactive bodies. MALSALLEZ, P. *Rev. Gén Élect.*, **56**, 139–43 (*March*, 1947) *In French.*—Variations in the current between two parallel plates when the air between them is irradiated were investigated, and the results are discussed. F. L. J.

537.563 1891

Effect of temperature on the mass spectra of hydrocarbons. FOX, R. E., AND HIPPLE, J. A. *J. Chem. Phys.* **15**, 208 (*April*, 1947).—Some ions (e.g. $C_4H_{10}^+$ from isobutane) formed by electron bombardment of a heated gas beam, show a very marked dependence of intensity on temperature.

537.564 1892

Ionization of mercury vapour by slow electrons. MCFADDEN, T. *Phil. Mag.*, **37**, 630–5 (*Sept.*, 1946).—Some of the experiments of Nottingham [Abstr. 1334 (1939)] were repeated using a space-charge detector both in the conventional manner and in a sensitive modified form. Details of the two tubes used are given. The results are mostly consistent with those of Nottingham; in particular there is evidence for the existence of considerable ionization below 10·4 V, almost certainly molecular (Hg_2) in origin. Some points of technique and interpretation in the measurement of critical potentials are discussed. L. S. G.

537.564 1893

Differences in mass spectra of H_2 and D_2. BAUER, N., AND BEACH, J. Y. *J. Chem. Phys.*, **15**, 150–1 (*March* 1947).—Measurements are reported of the relative numbers of atomic and molecular ions formed by bombardment of H_2 and D_2 respectively by electrons of energies up to 100 V. The ratio $(H^+/H_2^+)/(D^+/D_2^+)$ had values between 1·5 and 2·2.

537.564 : 551.510.535 *see Abstr.* 1988

537.568 : 539.132 1894

Validity of the Franck–Condon principle in collisions of the second kind. MEYEROTT, R. E. *Phys. Rev.*, **71**, 55 (*April* 15, 1947).—It is contended that no mechanism exists whereby colliding molecules could take up the large quantity of excess energy produced by the transfer of positive charge from O to O_2, from N_2 to O, and from N_2 to O_2 as proposed by Bates and Massey [Abstr. 895 (1947)]. W. E. D.

537.569.4 : 535.33.072–14 *see Abstr.* 1814

COSMIC RAYS 537.591

537.591 : 539.18 *see Abstr.* 1958

537.591.1 = 5 1895

The cosmic radiation spectrum at 2 200 m above sea level. COCCONI, G., AND TONGIORGI, V. *Ric. Sci.*, **13**, 21–6 (*Jan.*, 1942) *In Italian.*—Previous observations on a possible band-structure and the influence of the earth's magnetic field [Schremp and Baños, *Phys. Rev.*, **59**, 614 (1941); Abstr. 2698 (1940)] are discussed, and tables and graphs illustrate the results of a series of measurements at Passo Sella with counters in triple and quadruple coincidence and varying thicknesses of interposed Pb absorbers. Apparatus and operations are described. The experiments do not confirm a band structure for mesons between 1·7 and $2·7 \times 10^9$ eV. J. A. W.

537.591.1 = 5 1896

Some measurements on the electron component of the cosmic radiation. COCCONI, G., AND TONGIORGI, V. *Ric. Sci.*, **13**, 112–7 (*Feb.–March*, 1942) *In Italian.*—Tables and graphs of results of observations at Passo Sella (2 200 m) to test the validity of assumptions made in earlier experiments [Abstr. 1247 (1947)] on the E/M ratio. Counters were arranged at 45° and 59° zenith angle. Secondary diffusion does not affect previous results, lateral showers reduce the E/M values slightly but leave unaffected the variation with zenith angle. J. A. W.

37.591.1 : 539.18 *see Abstr.* 1959

37.591.15 = 5 1897

Showers of the meson component of cosmic rays amined by the Wilson chamber. COCCONI, G. *Ric.* ., 13, 314–8 (*June–July*, 1942) *In Italian.*—Showers in , Fe and Al were observed. From a discussion of the otographs obtained it is concluded that narrow showers nerated by mesons in materials of great thickness nsist of electrons multiplying in cascade. The fre- ency of showers increases with decreasing atomic mber of the material. Meson traces on the plates are e to primary mesons. J. A. W.

37.591.15 = 5 1898

On an extension of the theory of low-energy showers. ALLAPORTA, N., AND CLEMENTEL, E. *Nuovo Cim.* (*Sér.* 9) 235–50 (*Aug.*, 1946) *In Italian.*—Using an approximation ocess of calculation for the low energy part of the ectrum, the photonic and electronic components of scade showers in Pb are calculated in first approxima- on assuming theoretical values for the variation with ergy of the cross-section for pair production and of the ompton effect, and neglecting ionization energy losses r electrons. The results obtained confirm the great netration of photons in Pb for energies of about 6·5 eV. A.

37.591.2 1899

The determination of the sign and the energy spectrum primary cosmic radiation. VALLARTA, M. S., PERUSQUÍA, L., AND DE OYARZÁBAL, J. *Phys. Rev.*, 71, 393–8 pril 1, 1947).—An experiment is reported for the easurement of the complete azimuthal effect in Mexico ity (geomagnetic latitude 29°, altitude 2 242 m above a level) for constant zenith angles 20°, 40°, and 60°. he analysis yields an energy spectrum of the primary diation of the form $K/E^{1\cdot45}$ (E = energy, K = con- ant). There is no evidence of negative primary particles. he possibility of a line spectrum, or of such a spectrum perimposed on a continuous distribution, is not ruled t. The result is valid in the energy range from about 0 to 600 millistörmers, or 6 to 21×10^9 eV if the imaries are protons. A.

37.591.3 1900

Showers of penetrating particles at altitude of 26 000 ft. ATAGHIN, G. *Phys. Rev.*, 71, 453 (*April* 1, 1947).— bsorption measurements are consistent with an ex- onential absorption of the shower-producing primary diation. W. E. D.

37.591.3 = 5 1901

On the penetration of showers of cosmic rays at 120 m ad 2 200 m above sea level. COCCONI, G., AND ONGIORGI, V. *Ric. Sci.*, 13, 192–4 (*April–May*, 1942) *In alian.*—Quadruple coincidence measurements at Milan 20 m) and Passo Sella (2 200 m) show that electron owers can pass through 11 cm Pb at 2 200 m and cm Pb at 120 m; penetration of showers obtained with 5 cm and 3 cm show no difference. Shower-generating ectrons in 3 cm Pb have a higher penetrating power than ose in 1·5 cm. Shower penetration increases with titude. Tables of results are given. The intensity ratio btained agrees with previous observations [Abstr. 1554 947)]. J. A. W.

37.591.5 1902

Azimuthal variations of cosmic radiation at Lahore. LL, P. S. *Phys. Rev.*, 71, 398–9 (*April* 1, 1947).— osmic radiation at Lahore (22° N magnetic latitude) ows a large azimuthal effect. The effect in the NW. uadrant for a constant zenith angle of 60° is in general agreement with theoretical prediction. These observations lead to the conclusion that (1) primary cosmic-ray particles are positively charged, (2) the energy spectrum of the primary cosmic rays within the energy range $7\cdot84\times10^9$ to 14×10^9 eV (for protons) obeys the law $BE^{-\gamma}$ where $\gamma \simeq 2\cdot8$. A.

537.591.8 = 5 1903

The meson secondaries in materials of different atomic number. BALLARIO, C., AND BENINI, M. *Ric. Sci.*, 13, 136–8 (*Feb.–March*, 1942) *In Italian.*—Experiments are described, undertaken to clear up disagreement between previous observations [Froman and Stearns, *Phys. Rev.*, 54, 969 (1938); Abstr. 2843 (1939)]. The results, tabulated and graphed, illustrate how the observed dependence of meson secondaries on the atomic number of absorbing materials may lead to erratic conclusions from counter experiments. J. A. W.

537.591.8 = 5 1904

On the secondaries of the hard component of penetrating radiation. FERRETTI, B. *Ric. Sci.*, 13, 532–7 (*Oct.*, 1942) *In Italian.*—In discussing previous investigations [Abstr. 1802 (1940)] on the relation between the intensities of mesons and the accompanying electron component, a function $H(\varepsilon, \varepsilon_0)$ is introduced, expressing the sum of the trajectories of electrons of energy $>\varepsilon$ generated by an electron of energy ε_0, by means of which results in accord with experiments are reached. J. A. W.

537.591.8 : 539.172 = 5 *see Abstr.* 1951–2

MAGNETISM 538

538 1905

Magnetism. BOZORTH, R. M. *Rev. Mod. Phys.*, 19, 29–86 (*Jan.*, 1947).—A comprehensive article contributed to the *Encyclopaedia Britannica.*

538 : 525.24 : 530.1 *see Abstr.* 1715

538.11 1906

Existence of single magnetic poles. BENEDIKT, E. T., AND LENG, H. R. *Phys. Rev.*, 71, 454–5 (*April* 1, 1947).—A negative result was obtained in an experiment designed to observe the motion of an isolated magnetic pole round an electric current of 3 000 A. W. E. D.

538.11 : 538.65 *see Abstr.* 1916

538.22 : 537.311.31 : 539.231 = 4 *see Abstr.* 1972

538.22 : 620.179.14 : 621.317.4 1907

Magnetic testing. SANDFORD, R. L. *Circ. U.S. Bur. Stand.* (*No. C*456) 40 *pp.* (1946).—[Abstr. 1705 B (1947)].

538.224 1908

Magnetic anisotropy of molybdenite at different temperatures. DUTTA, A. K. *Indian J. Phys.*, 19, 225–34 (*Dec.*, 1945).—The diamagnetic anisotropy and one of the principal susceptibilities of molybdenite crystals have been measured from 700° down to 80°K. At low temperatures, the anisotropy tends to become independent of the temperature and at high temperatures its variation tends to obey approximately the Curie law. The presence of metallic electrons having their motions restricted along the basal plane has been concluded. A.

538.224 1909

The de Haas–van Alphen effect in a single crystal of Zn. MARCUS, J. A. *Phys. Rev.*, 71, 559 (*April* 15, 1947).—A single crystal of Zn shows this effect [Abstr. 2624 (1938), 1830 (1939)] in a direction || to the hexagonal axis, but not in a direction ⊥ to this. W. E. D.

538.224 : 535.342 : 539.11 : 536.212 : 537.311.33 *see Abstr.* 1864

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 = 3 1910

The mechanism of the electric field. FLAMM, L. *Öst. Ing. Arch.*, **1**, 105–17 (*July*, 1946) *In German.*—A mechanical theory of the electromagnetic field is presented. By regarding the lines of electric force as in motion, field equations are obtained for regions free from charge, and these agree with Maxwell's equations. L. S. G.

538.3 : 530.12 *see Abstr.* 1717

538.3 : 621.3.013.1 : 621.385.16.029.6 1911

A flux plotting method for obtaining fields satisfying Maxwell's equations, with applications to the magnetron. CROUT, P. D. *J. Appl. Phys.*, **18**, 348–55 (*April*, 1947).—Methods previously applied to fields satisfying Laplace's and Poisson's equations [Abstr. 748 B (1939)] are extended to fields satisfying Maxwell's equations. Application is made to the hole and slot, and vane types of magnetrons. A.

538.56 : 537.525 = 3 *see Abstr.* 1871

538.566 : 621.396.611.4 1912

Velocity of electromagnetic waves. ESSEN, L. *Nature, Lond.*, **159**, 611–12 (*May* 3, 1947).—A value of 299 793 ± 9 km/s has been obtained from measurements of resonant frequency of a short length of cylindrical waveguide. This is 17 km/s > the accepted value for light.

538.566.3 : 551.510.535 : 621.396.11 1913

On the propagation of electromagnetic waves through the atmosphere. BANERJEA, B. K. *Proc. Roy. Soc. A*, **190**, 67–81 (*June* 17, 1947).—A general method of tackling the problem of the propagation of electromagnetic waves in the ionosphere has been developed and current methods deduced as special cases from the general results, with their different assumptions regarding the condition of reflection of the waves from the ionosphere shown to be identical. A correspondence chart for the symbols used by the different workers is given to facilitate the understanding of the parallelism between the different methods. Polarization of the radio waves is discussed fully. A.

538.569.3 : 621.396.11 : 621.317.374 1914

The "black body" for radio waves. MALOV, N. *J. Phys., USSR*, **10** (*No.* 4) 383–5 (1946).—The conditions under which there shall be no reflection from a semi-conducting plate (thickness d) backed at distance l by a perfectly conducting plate, are investigated theoretically for different ranges of permittivity and loss of the semi-conductor, both in free space and in a waveguide. It is suggested that experimental observations of d and l at high frequencies would enable the electrical properties of the semi-conductors to be determined.

538.569.4 : 535.343.4–14 *see Abstr.* 1823–5

MAGNETIC EFFECTS 538.6

538.65 : 532.612.4 = 4 1915

Orientation phenomena in nematic liquids. A new method of measurement of surface tension applicable to these liquids. NAGGIAR, V. *Ann. Phys., Paris* (*Sér.* 11) **18**, 5–55 (*Jan.–March*, 1943) *In French.*—Discusses the phenomena in *p*-azoxyanisol, and describes experiments with magnetic and electric fields. The surface tension was determined by optically measuring the curvature of a small vertical cylinder of the liquid hanging in a vertical hole in a 3-mm plate. L. G. C.

538.65 : 538.11 1916

Magnetic ions and magnetic currents. KANE, G. *Phys. Rev.*, **71**, 458–9 (*April* 1, 1947).—Experiments on magneto-photophoresis are discussed, including one in which conditions are such that metallic particles move against gravity even in the absence of light. The explanation here given is that a current is induced in the particles by the rapidly varying magnetic field, thus causing the motion. Experiments are described which support this explanation. W. E. D.

538.652 : 534.321.9 : 534.612 *see Abstr.* 1781

ATOMIC AND MOLECULAR STRUCTURE 53

539.11 : 536.212 : 538.224 : 535.342 : 537.311.33 *see Abstr.* 1864

539.11 : 539.215.4 *see Abstr.* 1971

539.11 : 541.57 : 669 191

Atomic radii and interatomic distances in metals. PAULING, L. *J. Amer. Chem. Soc.*, **69**, 542–53 (*March* 1947).—The change in covalent (metallic) radius of an atom with change in bond number (or with change in co-ordination number if valency remains constant) is expressed by an equation which also takes into account the stabilizing effect of the resonance of shared-electron pair bonds among alternative positions. By applying the equation to empirical interatomic distance data for the elementary metals, an almost complete set of single bond radii have been derived and are compared with normal covalent, tetrahedral and octahedral radii of the elements. This comparison lends support to the view that interatomic forces in metals are due essentially to covalent bonds resonating among available interatomic positions. Cr, Mn and Sn atoms exist in metals in two forms, a small high-valent and a larger low-valent form. An atom in a metal appears, generally, to be attached to some of its neighbours by strong bonds and to others by weaker bonds. In β-W and α-U there are straight strings of strongly-bonded atoms. Applications of the radii to Fe_3C and AuSn is made. W. R. A.

539.11 : 548.7 191

A method for obtaining electronic eigenfunctions and eigenvalues in solids with an application to sodium. VOORDER LAGE, F. C., AND BETHE, H. A. *Phys. Rev.*, **71**, 612–22 (*May* 1, 1947).—The method is a development of the Wigner–Seitz and Slater cellular approximations [Abstr. 2992, 4369 (1934)], in which the valence electron potential is assumed to be spherically symmetrical within a lattice cell. It was tested satisfactorily by applying it to Shockley's empty lattice [Abstr. 4797 (1937)]. An application to the calculation of the Brillouin zones of Na is given.

539.132 191

Vibrational frequencies of semirigid molecules: general method and values for ethylbenzene. TAYLOR, W. J., AND PITZER, K. S. *J. Res. Nat. Bur. Stand., Wash.* **38**, 1–17 (*Jan.*, 1947).—It is shown that in normal co-ordinate calculations of the vibrations of molecules it is sometimes advantageous to calculate the kinetic-energy matrix, rather than the reciprocal kinetic-energy matrix. Explicit formulae are given for its elements, and illustrative calculations are given for propane, toluene, and ethylbenzene. A semi-empirical assignment of the vibration frequencies of ethylbenzene is made on the basis of these calculations and the spectroscopic data.

539.132 192

Molecular coupling effects. VALATIN, J. G. *Phys. Rev.* **71**, 458 (*April* 1, 1947).—A co-ordinate reference system is suggested which permits a clearer insight into the mechanism of rotational coupling effects in diatomic molecules. W. E. I.

)132 1921
On the theory of accidental predissociation. KOVÁCS, AND BUDÓ, A. *J. Chem. Phys.*, **15**, 166–73 (*April*, 47).—The case of perturbation between two discrete d one continuous term series is investigated. Even ough no interaction between the first discrete and the ntinuous states exists, a considerable predissociation y arise for some spectrum lines in case of coincidence close proximity between the levels of the two discrete ms belonging to the same rotational quantum number. e predissociation occurring in the first discrete term is used by the second. This phenomenon is called cidental predissociation. A.

)132 = 4 1922
Degenerate vibrations of molecules and movement of the ipsoid of refractivity. KASTLER, A. *Ann. Phys., Paris r.* 11) **20**, 455–508 (*Sept.–Oct.*, 1945) *In French.*

)132 = 4 1923
Degenerate vibrations of molecules and the complex isor of polarisability. KASTLER, A. *Ann. Phys., Paris ér.* 12) **1**, 495–521 (*Sept.–Oct.*, 1946) *In French.*

9.132 : 535.375.5 *see Abstr.* 1834

9.132 : 537.568 *see Abstr.* 1894

9.133 = 5 1924
Dipole moments in diatomic molecules. PUPPI, G. *uovo Cim.* (*Sér.* 9) **3**, 251–6 (*Aug.*, 1946) *In Italian.*—The riation of dipole moment of diatomic molecules with larized single band is examined, as due to an axial ctric field, and supposing the main perturbation to nsist in a change of the ratio b/a between ionic and valent wave-function coefficients. As application, an pproximate expression for the ratio $(E_i - E_0)/(E_c - E_0)$ terms of ionic and covalent wave-function coefficients d overlapping is given. (E_0, E_i, E_c = energies at a ven internuclear distance of normal, ionic and covalent nfigurations).

39.152.1 1925
Erratum: On the scattering and absorption of particles atomic nuclei. FESHBACH, H., PEASLEE, D. C., AND EISSKOPF, V. F. *Phys. Rev.*, **71**, 564 (*April* 15, 1947).—esults previously reported [Abstr. 1263 (1947)] are ly correct if the nuclear spin is zero. W. E. D.

39.152.1 : 530.14 *see Abstr.* 1723–6

39.152.1 : 539.163.2 *see Abstr.* 1944

39.152.1 : 539.185.7 *see Abstr.* 1970

39.152.2 1926
Magnetic moment of the triton. SACHS, R. G. *Phys. ev.*, **71**, 457 (*April* 1, 1947).—The admixture of states cessary to account for the value of the magnetic oment of the triton as determined by Anderson and fovick [Abstr. 1592 (1947)] is discussed. W. E. D.

39.152.2 1927
Relative moments of H_1 and H_3. BLOCH, F., GRAVES, . C., PACKARD, M., AND SPENCE, R. W. *Phys. Rev.*, **71**, 51 (*April* 15, 1947).—A more accurate determination ee Abstr. 1593 (1947)] gives a value of $1{\cdot}066636 \pm {\cdot}00001$ for the ratio of the triton and proton magnetic oments. W. E. D.

39.152.2 : 530.12 1928
Relativistic corrections to magnetic moments of nuclear articles. BREIT, G. *Phys. Rev.*, **71**, 400–2 (*April* 1, 947).—The validity of the addition of proton and eutron magnetic moments to give that of the deuteron ould not be denied on the grounds of these corrections. better knowledge of the interactions is needed before e corrections can be known to be large enough. G. J. K.

539.154.2 1929
The number of elements. MASSIERA, M. *Phys. Rev.*, **71**, 458 (*April* 1, 1947).

539.155.2 : 536.423.1 1930
Concentration of the isotopes of mercury by free evaporation in a 10-cell counter-current reflux still. BREWER, A. K., AND MADORSKY, S. L. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 129–35 (*Jan.*, 1947).—A maximum change of density of 161·6 ppm was obtained. Distillation temperatures varied from 55° to 100°C. A single-stage molecular still was also operated at temperatures varying from 108·1° to 128°C. The results agree with those obtained previously by other investigators. A.

539.155.2 : 539.172.4 1931
A mass spectrometer investigation of the isotopes of xenon and krypton resulting from the fission of U^{235} by thermal neutrons. THODE, H. G., AND GRAHAM, R. L. *Canad. J. Res. A*, **25**, 1–14 (*Jan.*, 1947).—Irradiated U rods were allowed to stand for various periods of time after irradiation to permit the decay of most fission product chains to stable isotopes. Four stable isotopes of Xe were found having mass numbers 131, 132, 134, and 136, and three of Kr with mass numbers 83, 84, and 86. Kr^{86}, the most abundant of the latter group, is probably formed directly in fission. The relative abundances were determined with an accuracy of 1% or better. In addition, a long lived Kr^{85} was discovered which is isomeric with a 4·0-hr Kr^{85} reported previously. A.

539.155.2 : 541.133.1 1932
Concentration of isotopes of potassium by the counter-current electromigration method. BREWER, A. K., MADORSKY, S. L., TAYLOR, J. K., DIBELER, V. H., BRADT, P., PARHAM, O. L., BRITTEN, R. J., AND REID, J. G., JR. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 137–68 (*Feb.*, 1947).—A full description of the methods and results reported earlier [Abstr. 3218 (1946)]. The theoretical expression for the separation coefficient is derived, and the practical factors influencing efficiency are discussed. Concentration of K^{39} in the cathode compartment, or K^{41} in the anode compartment, led to abundance ratios K^{39}/K^{41} of 24 and 9·1 respectively. In the former case, it was shown that the abundance ratio decreases rapidly from the cathode to anode direction. The mass spectrometer used for measurement of abundance ratio, and the automatic flow control regulation, are also described. A.

539.155.2 :541.133.1 1933
Concentration of potassium^{39} by countercurrent electromigration: some theoretical aspects of the operation. WESTHAVER, J. W. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 169–85 (*Feb.*, 1947).—Equations are derived which describe the operations (1) for the early stages of the run, (2) after infinite time with no production, and (3) after infinite time at fixed production. The formulae under (1) enable evaluation of the elementary separation coefficient, ε. Those under (2) enable calculation of the maximum separation in terms of various channeling factors which determine the length of theoretical unit cell, h. Those under (3) enable calculation of optimum production conditions. When measured by the smallness of h, the analysis depicts the fractionator as one which is about 100 times more powerful than a modern laboratory distillation column. A.

539.155.2 : 541.133.1 1934
Concentration of isotopes of chlorine by the counter-current electromigration method. MADORSKY, S. L., AND STRAUS, S. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 185–9 (*Feb.*, 1947).—NaCl was used as the electrolyte; the operation was regulated by means of a stationary

boundary between solutions of NaOH and NaCl as the lower and upper liquids, respectively. A concentration of Cl^{35} to a max. value of 80·7% was obtained in 474 hours. The max. initial separation coefficient, $\varepsilon - 1$, was $0{\cdot}207 \times 10^{-2}$. A.

539.155.2 : 550.93 = 3 1935

Isotope abundances in natural lead and the age of uranium. HOUTERMANS, F. G. *Naturwiss.*, **33**, 185–6 (*Sept.* 30); *addendum and erratum, ibid.*, 219 (*Oct.* 15, 1946) *In German.*—Knowing the isotope analysis of ordinary Pb it is possible to arrive at the composition of "natural" Pb of non-radioactive origin. The values obtained are Pb^{204}, $1{\cdot}72 \pm 0{\cdot}05$; Pb^{206}, $19{\cdot}81 \pm 1{\cdot}00$; Pb^{207}, $24{\cdot}13 \pm 0{\cdot}43$; Pb^{208}, $54{\cdot}34 \pm 1{\cdot}10$%. The age of inactive Pb minerals can also be obtained. A Swedish Pb was found to have an age of $(1\,700 \pm 100) \times 10^9$ years. The age of U minerals crystallizing simultaneously can thus be arrived at. The result is in satisfactory agreement with astrophysical and radioactive data. A. J. M.

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16.08 : 519.21 1936

On the distribution of counts in a counting apparatus. HOLE, N. *Ark. Mat. Astr. Fys.*, **33 B** (*No.* 3) *Paper* 8, 8 *pp.* (1947).—A continuation of a previous paper [Abstr. 148 (1947)]. The expression for the probability distribution is extended to counts on a scale-of-x apparatus. L. E. M.

539.163 1937

Total disintegration energy of Na^{24}. BARKER, E. C. *Phys. Rev.*, **71**, 453–4 (*April* 1, 1947).—The γ-energy per disintegration was measured [similar method to Abstr. 2025 (1937)] as $\sim 4{\cdot}17$ MeV, to which the β-energy of 1·39 MeV is to be added. [See Abstr. 95 (1947)].

539.163 1938

Slow neutron-induced activity in gold. SIEGBAHN, K. *Proc. Roy. Soc. A*, **189**, 527–35 (*June* 3, 1947).—The 2·7-day activity in Au^{198} has been studied by means of a β-spectrometer of the lens type in conjunction with a special technique for studying the γ-radiation. The β-spectrum has an upper limit = 0·92 MeV. An absorption measurement on the γ-radiation in Pb shows that no high-energy γ-radiation is existent, as has previously been reported. Only one γ-ray of medium energy (0·401 MeV) follows the β-disintegration. A.

539.163 1939

The assignment of the slow-neutron-produced activities of thallium and the dual disintegration of radium E. BRODA, E., AND FEATHER, N. *Proc. Roy. Soc. A*, **190**, 20–30 (*June* 17, 1947).—Recoil experiments with a strong source of RaE (21 mC initial activity) electrolytically deposited on Pt show that an activity of ½-value period 4·2 min is obtained. This observation indicates that RaE undergoes dual disintegration with an $\alpha : \beta$ branching ratio of the order of 5×10^{-7}. Rough absorption measurements favour the identification of the activity with the 4·2-min. activity produced in the (n, γ) and (d, p) reactions with Tl, and therefore require assignment of the latter to Tl^{206}, contrary to earlier suggestions. Consideration of the energies involved shows that the postulated $\alpha : \beta$ branching ratio has roughly the value which would be predicted on the basis of accepted regularities. A.

539.163 : 539.172.4 1940

Radioactivity of Be^{10}. LEVINGER, J., AND MEINERS, E. *Phys. Rev.*, **71**, 586–8 (*May* 1, 1947).—From the β-activity induced in Be by (1) fast deuteron bombardment, and (2) slow neutron capture, the ½-life of Be^{10} is determine as between 10^6 and 10^7 years. The β-end-point i ~ 650 keV, and no γs were observed. [See Abstr. 319 (1946)]. The $B^{10}(n, p)Be^{10}$ cross-section for therm neutrons is computed by comparison with the know value for $B^{10}(n,\alpha)Li^7$, assuming disintegration to th ground state possible for the former reaction.

539.163.1 194

Artificial radioactive isotopes of Po, Bi and Pl HOWLAND, J. J., TEMPLETON, D. H., AND PERLMAN, *Phys. Rev.*, **71**, 552 (*April* 15, 1947).—Half lives an modes of decay are assigned to the various isotopes c Po, Bi and Pb. W. E. D

539.163.1 194

A calorimetric determination of the energy produced b plutonium (239). STOUT, J. W., AND JONES, W. M *Phys. Rev.*, **71**, 582–5 (*May* 1, 1947).—The rate c evaporation of liquid N by a 120 g sphere of metalli Pu^{239} was measured and compared with that produce by the introduction of electrical energy. From the know energy per α-particle determined from range and range energy measurements, $2{\cdot}411 \times 10^4$ years is obtained a the ½-life of Pu^{239} with respect to α emission. A

539.163.2 194

Forty-three day $_{48}Cd^{115}$. SEREN, L., ENGELKEMEIR, D STURM, W., FREIDLANDER, H. N., AND TURKEL, S. *Phy Rev.*, **71**, 409–12 (*April* 1, 1947).—This has been dis covered while irradiating Cd with slow neutrons. Th radiation consists of β-rays of energy $\sim 1{\cdot}5$ MeV, an with $\sim$ one 0·5 MeV γ-ray per disintegration. Th radio-element was chemically identified as Cd, and th mass assignment to $_{48}Cd^{115}$ was made by a fast neutro $In^{115}(n, p)Cd^{115}$ reaction. A

539.163.2 : 539.152.1 194

Nuclear levels in ThC′ and ThD as studied by means o their γ-rays. JOHANSSON, A. *Ark. Mat. Astr. Fys.*, **34** (*Paper* 9) 8 *pp.* (*Prepr.*, 1947).—The γ-radiation fro Th(C + C′ + C″) was studied by means of its secondar electrons in a β-spectrometer. The existence of γ-rays o 1·03 and 0·84 MeV energy was established. The rati of the intensities of the 0·58 and 0·51 MeV γ-rays wa estimated to be 2 : 1. An improved term scheme fo ThC′ has been constructed.

539.163.2 : 615.849 194

Average energy of beta-rays emitted by radioactiv isotopes. MARINELLI, L. D., BRINCKERHOFF, R. F., AN HINE, G. J. *Rev. Mod. Phys.*, **19**, 25–8 (*Jan.*, 1947).— The average kinetic energy $\bar{E}_\beta$ has been computed fo those radio elements whose spectra have been adequatel investigated, and the results are shown in a table, togethe with ½-life, spectral limit E_0 and maximum range i water. Complex spectra have been broken down an components averaged separately. $\bar{E}_\beta$ was also calculate by means of Fermi's theory, and a graph compares th experimental and calculated values; only the Ra forbidden spectrum markedly fails to agree.

539.165.08 : 537.533.72 *see Abstr.* 1880

539.165.2 194

Maximum β-energies and the mass of the neutrino KOFOED-HANSEN, O. *Phys. Rev.*, **71**, 451–2 (*April* 1 1947).—It is shown that the error in determining th extrapolated maximum β-ray energy is of the sam magnitude as that in the neutrino mass determined fror the shape of the curves, and so cannot give a mor accurate value of the neutrino mass. G. J. F

539.165.2 194

Electron-neutrino angular correlation in beta-decay HAMILTON, D. R. *Phys. Rev.*, **71**, 456–7 (*April* 1, 1947).—

pressions are given for the angular correlation function the allowed and first forbidden transitions in β-decay responding to 5 invariant forms of β-interaction. W. E. D.

.166 : 539.172.3 : 539.17 *see Abstr.* 1949

.167.3 1948

On the activation of dysprosium by slow neutrons. TIS, H. *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 3) *Paper* 17, pp. (1947).—Investigation of the γ-radiation from ^{165} gives a $\frac{1}{2}$-life of 145 $\pm$ 3 min for this nucleus. The per energy limit of the β-radiation determined from its orption in Al is 1·17 MeV, and determined by means the magnetic lens spectrograph, 1·24 $\pm$ 0·03 MeV. sorption measurements in Pb showed the existence of least two γ-radiations, with energies $\sim$0·125 and MeV. The photo- and Compton-effects indicate the sence of three kinds of γ-radiation. Two internal version lines were detected in the β-spectrum, the ergies being 35·4 and 82·2 keV. They were caused by K and L electrons, respectively, of Ho. Fermi grams show that the β-spectrum has at least three mponents. The number of γ-quanta per disintegration 4. A decay scheme is suggested. A. J. M.

9.17 : 539.166 : 539.172.3 1949

Yield of photo-neutrons from U^{235} fission products in avy water. BERNSTEIN, S., PRESTON, W. M., WOLFE, G., D SLATTERY, R. E. *Phys. Rev.*, **71**, 573–81 (*May* 1, 47).—The fission products were placed at the centre of 0-in radius sphere of heavy water, and the emission of rd γ-rays investigated by measuring the photo-neutron ld. Eight $\frac{1}{2}$-lives were found, varying from 2·5 sec to hrs, most of the photo-neutrons being due to the short-riod activities. It is calculated that 1 to 2 photons of ergy >2·2 MeV are emitted per fission by fission oducts with $\frac{1}{2}$-lives >1 sec. A.

9.172 1950

Note on the calculation of angular distributions in sonance reactions. BREIT, G., AND DARLING, B. T. *ys. Rev.*, **71**, 402–5 (*April* 1, 1947).

9.172 : 537.591.8 = 5 1951

A special type of nuclear disintegration recorded on the otographic plate exposed to cosmic agents. BRUNETTI, , AND OLLANO, Z. *Ric. Sci.*, **13**, 106–11 (*Feb.–March*, 42) *In Italian.*—A series of branched-trace records are own and discussed. The 2-branch traces are attributed an intermediate process between simple nuclear fission Br or Ag and multi-branched proton or neutron aces, due to an electron or photon of the soft cosmic-y component. J. A. W.

9.172 : 537.591.8 = 5 1952

On the disintegrations produced by cosmic radiation on otographic plates. LOVERA, G. *Ric. Sci.*, **13**, 538–41 Oct., 1942) *In Italian.*—A number of plates exposed at 800 m altitude for about 1 year are analysed, and the ass m for each trace is calculated from the formula $= I^2/2E$, I being the impulse, E total energy. Accord-g to Bagge [Abstr. 2597 (1941)] m refers to nuclear mponents set in motion by direct action of the radiation. he statistical analysis is given. J. A. W.

39.172 : 539.185 1953

Delayed neutrons from Pu^{239}. WILSON, R. R. *Phys. ev.*, **71**, 560 (*April* 15, 1947).—Delayed neutrons from U^{239} are about half as frequent as those from U^{235} but ave the same decay period indicating that they issue om a common fission product. W. E. D.

39.172.13 : 539.185 *see Abstr.* 1963

39.172.3 : 539.166 : 539.17 *see Abstr.* 1949

539.172.4 1954

Reaction $_{38}Sr^{86}(n, \gamma)_{38}Sr^{87}*$ produced by thermal neutrons. SEREN, L., FREIDLANDER, H. N., AND TURKELL, S. *Phys. Rev.*, **71**, 454 (*April* 1, 1947).

539.172.4 1955

Emission of secondary charged particles in fission. FEATHER, N. *Nature, Lond.*, **159**, 607–8 (*May* 3, 1947).—An explanation is offered for the rare emission of an α-particle by fission fragments in a time $\ll$ that required for "normal" α-emission by such nuclei. [Abstr. 2943 (1946), 1300 (1947)]. This is, that α-particles are only emitted by nuclei in narrow atomic number bands, $Z \simeq 40$ and $Z \simeq 60$ (which are only rarely formed in fission), and the emission takes place during the period ($\sim 10^{-20}$ sec ?) before the fragment nuclei have dissipated their initial energy of deformation.

539.172.4 = 5 1956

On the disintegration of uranium. FRANZINI, T., AND GALLI, M. G. *Ric. Sci.*, **12**, 1157–60 (*Nov.*, 1941) *In Italian.*—With an automatically recording Wilson chamber, 2 100 photographs were obtained, of which 1 400 with the neutrons (Rn + Be) slowed down in 2·5 cm paraffin. A double cone-shaped trace is attributed to two fragments of a U atom, some traces are attributed to heavy fragments, two branched traces are discussed in detail. J. A. W.

539.172.4 : 539.155.2 *see Abstr.* 1931

539.172.4 : 539.163 *see Abstr.* 1940

539.172.4 : 539.185 1957

Total neutron cross section of dysprosium and neodymium. STURM, W. J., AND ARNOLD, G. P. *Phys. Rev.*, **71**, 556–7 (*April* 15, 1947).—Using a LiF (111) crystal as a neutron monochromator, two resonance levels at 1·74 and 5·5 eV are found in Dy with evidence of one at 20 eV and one at a negative energy. An approximate value of 92×10^{-24} cm^2 is given for the cross-section of Nd with neutrons of 0·025 eV energy. W. E. D.

539.18 : 537.591 1958

Erratum: On the disintegration of negative mesons. CONVERSI, M., PANCINI, E., AND PICCIONI, O. *Phys. Rev.*, **71**, 557 (*April* 15, 1947).—Correction of apparatus details [Abstr. 1313 (1947)]. W. E. D.

539.18 : 537.591.1 1959

The mass of the mesotron as determined by cosmic-ray measurements. HUGHES, D. J. *Phys. Rev.*, **71**, 387–92 (*April* 1, 1947).—The errors involved in the different methods are discussed, and the possibility of reducing them by choice of experimental conditions. The errors and the mass values themselves of 47 published measurements are reviewed. The great majority are statistically reconcilable with a single mass of $\sim$200 electron masses; only a very small fraction of the mesotrons seem to have significantly different masses. A.

539.185 1960

Measurement of the diffusion length of thermal neutrons in graphite. HEREWARD, H. G., LAURENCE, G. C., PANETH, H. R., AND SARGENT, B. W. *Canad. J. Res. A*, **25**, 15–41 (*Jan.*, 1947).—The theory and method are discussed in detail. The source was 1·2 gm of Ra mixed with Be. Part of a pile was used to slow down the neutrons to thermal velocities, and the density distribution of thermal neutrons explored in the remainder with detectors of Dy oxide. The diffusion length of thermal neutrons in this graphite of average pile density 1·55 g/cm^2 was found to be 51 cm, with a probable error of 3 cm. A.

539.185 1961

The preparation of pressed Ra + Be neutron sources.

ANDERSON, H. L., AND FELD, B. T. *Rev. Sci. Instrum.*, **18**, 186–8 (*March*, 1947).—A method giving densities $\sim 1{\cdot}75$ g/cm³ is described in detail. Such sources can be made to contain as much as 5 g of Ra. They have the advantage of small volume and constancy of neutron output. A.

539.185 = 5 1962

On the elastic scattering of fast neutrons by medium and heavy nuclei. AMALDI, E., BOCCIARELLI, D., CACCIAPUOTI, B. N., AND TRABACCHI, G. C. *Nuovo Cim.* (*Sér.* 9) **3**, 203–34 (*Aug.*, 1946) *In Italian.*—D + Li neutrons were used, detected by the activity induced in Cu, which has a 11 MeV threshold. The total cross-section was measured for 18 elements and their nuclear radii calculated; the cross-section for absorption + inelastic scattering was measured for Al, Fe, Hg, and Pb, and was found to be $\sim \frac{1}{2}$ the total cross-section. The angular distribution of the elastically scattered neutrons was measured for Pb; the cross-section has a min. at $\sim 25°$ and a max. at 35–40°, from which a nuclear radius of 10^{-13} cm is deduced. A.

539.185 : 539.172 *see Abstr.* 1953

539.185 : 539.172.13 1963

Neutrons from $C^{12} + D$. BENNETT, W. E., AND RICHARDS, H. T. *Phys. Rev.*, **71**, 565–7 (*May* 1, 1947).—Recoil protons in a cloud chamber have been used to measure the energy spectrum of the neutrons, which were found to be monochromatic when produced by 2 MeV deuterons. An accurate Q value of $-0{\cdot}27 \pm 0{\cdot}02$ MeV is computed from the range of the recoil protons, and gives a mass of $13{\cdot}00988 \pm 0{\cdot}00004$ for N^{13}. A.

539.185 : 539.172.4 *see Abstr.* 1957

539.185.08 1964

Energy sensitivity of fast neutron counters. BARSCHALL, H. H., AND BETHE, H. A. *Rev. Sci. Instrum.*, **18**, 147–9 (*March*, 1947).—The energy sensitivity of counters using recoils from a radiator or recoils produced in a gas is discussed. A.

539.185.1 1965

The neutron-hydrogen mass difference and the neutron mass. STEPHENS, W. E. *Rev. Mod. Phys.*, **19**, 19–24 (*Jan.*, 1947).—Data in the literature are summarized. The disintegration energy of the deuteron together with the HH–D mass-spectroscopic doublet separation apparently yields the best value of $n - H = 0{\cdot}755 \pm 0{\cdot}016$ MeV and a neutron mass of $1{\cdot}008941 \pm 0{\cdot}00002$ mass units. Other transmutation-radioactivity cycles check this value. Several inconsistencies in these data and their possible explanation are pointed out. Experiments of interest for improvement in accuracy and reliability of these values are noted. A.

539.185.7 1966

Note on the spherical harmonic method as applied to the Milne problem for a sphere. MARSHAK, R. E. *Phys. Rev.*, **71**, 443–6 (*April* 1, 1947).—The spherical analogue of the Milne problem for the half-plane is treated by an approximate method based on expanding the neutron distribution function in a finite number of spherical harmonics. The neutron distribution is calculated in the first two approximations. Values of the "extrapolated endpoint" are tabulated as a function of the radius of the sphere. A.

539.185.7 1967

Neutron cross sections for Hg isotopes. INGHRAM, M. G., HESS, D. C., JR., AND HAYDEN, R. J. *Phys. Rev.*, **71**, 561–2 (*April* 15, 1947).—A table is given showing the cross-section for neutron capture of the various Hg isotopes and it is deduced that Hg^{199} is the isotope chiefly concerned with neutron absorption by normal Hg. W. E. D.

539.185.7 196

The transmission of slow neutrons through microcrystalline materials. FERMI, E., STURM, W. J., AND SACHS, R. G. *Phys. Rev.*, **71**, 589–94 (*May* 1, 1947).—The transmission of monochromatic slow neutrons through microcrystalline Be and BeO has been determined. The results are in excellent agreement with the theory of elastic scattering from crystals. [Abstr. 1927 (1941), 1161 (1944)]. It is found that the scattering amplitudes of Be and O have the same sign, and this method may be used to determine the relative scattering phases of other pairs of nuclei which can be combined to form a crystalline material. The sample must consist of crystals <1 micron in linear dimensions. Other possible sources of disagreement between theory and experiment are discussed. A.

539.185.7 = 5 196

On proton-neutron collision. II. AMALDI, E., BOCCIARELLI, D., FERRETTI, B., AND TRABACCHI, G. C. *Ric. Sci.* **13**, 502–31 (*Oct.*, 1942) *In Italian.*—For I, see Abstr. 1649 (1947). Using neutrons from the reactions $B^{11}(d, n)C^{12}$ and $Li^7(d, n)Be^8$ incident in a paraffin layer (5–10 mg/cm²) in the shape of a circular arc, counters in triple coincidence and Al absorbers of different thickness, the integral spectrum of recoil protons was obtained. Neutrons of 4 energy values between 12·5 and 15 MeV were used and the anisotropy of the proton diffusion was established as dependent on neutron energy. The only theory which accounts satisfactorily for the experimental results is Bethe's "neutral" theory. Apparatus is described and illustrated in detail, theory is given and results are tabulated, graphed and discussed. J. A. W.

539.185.7 : 530.14 *see Abstr.* 1727

539.185.7 : 539.152.1 197

On the neutron-proton scattering cross section. BOHM, D., AND RICHMAN, C. *Phys. Rev.*, **71**, 567–72 (*May* 1, 1947).—The sensitivity of the theoretical cross-section to possible variations in the quantities defining the potential has been investigated in the energy range from 0 to 6 MeV. The variations in exchange or tensor character and range of the potential which are consistent with what is known about the interaction do not result in so large a modification of the predicted cross-section as do variations in shape. A well resembling a Yukawa potential ($A \exp(-\alpha r)/r$) is found to yield a cross-section at 6 MeV which is 10% < that given by a square well fitted to the epithermal neutron cross-section and the binding energy of the deuteron, and is in better agreement with experiment. The epithermal neutron scattering cross-section in H has been determined, by extrapolating the data of Frisch [Abstr. 999 (1947)] to be $20{\cdot}8 \times 10^{-24}$ cm². A.

STRUCTURE OF SOLIDS 539.2

539.215.4 : 535.43 : 539.26 : 537.531 *see Abstr.* 1877–8

539.215.4 : 539.11 197

Grain growth in high purity Al. BECK, P. A., KREMER, J. C., AND DEMER, L. *Phys. Rev.*, **71**, 555 (*April* 15, 1947).—Measurements of grain growth at different temps. lead to a value for the heat of activation for Al 50 to 100% > that obtained for self-diffusion. A crude comparison for brass shows a similar discrepancy. W. E. D.

539.231 : 537.311.31 : 538.22 = 4 197

Properties of sputtered nickel films. COLOMBANI, A. *Ann. Phys., Paris* (*Sér.* 11) **19**, 272–326 (*July–Sept.*, 1944) *In French.*—Gives a technique for the production of homogeneous oxide-free films, and a description of their properties. The variation of resistivity with thickness is

asured, and it is shown, by X-ray examination, that n films are amorphous. Films thicker than 220 mμ ow a hexagonal close-packed structure and above 0 mμ the usual face-centred cubic structure of Ni pears. Measurements are made of the variation of istivity with temperature and of the magnetic pro- rties. A full bibliography is given. J. T.

9.26 : 539.215.4 : 535.43 : 537.531 *see Abstr.* 1877–8

ASTICITY . STRENGTH . RHEOLOGY 539.3/.8

9.32 1973

Elastic constants of $NaClO_3$. BHAGAVANTAM, S., AND RYANARAYAN, D. *Phys. Rev.*, **71**, 553 (*April* 15, 1947). The present results are in agreement with those of Mason [Abstr. 334 (1947)] in giving a positive value for Poisson's ratio. W. E. D.

539.32 : 536.631 *see Abstr.* 1859

539.374 1974

An introduction to the mathematical theory of plasticity. PRAGER, W. *J. Appl. Phys.*, **18**, 375–83 (*April*, 1947).—The principal theories of plasticity are outlined. The discussion is restricted to the mechanical behaviour of plastic materials under shear. Theories of plastic deformation (Hencky, Nadai) and theories of plastic flow (Saint Venant-Lévy-Mises, Prandtl-Reuss, Prager) are illustrated by the example of a prismatic bar under torsion. A.

539.42 : 532.123 *see Abstr.* 1747

PHYSICAL CHEMISTRY 541

ELECTROCHEMISTRY 541.13

1.133.1 : 539.155.2 *see Abstr.* 1932–4

CHEMICAL STRUCTURE 541.4/.6

541.57 : 535.341–15 *see Abstr.* 1818
541.57 : 667 : 539.11 *see Abstr.* 1917

OLLOIDS . DISPERSE SYSTEMS 541.18/.182

1.18.043 : 531.382 *see Abstr.* 1739

CHEMICAL ANALYSIS 543/545

545.822 : 537.523.5 *see Abstr.* 1870
545.822 : 621.383.2 : 535.243 *see Abstr.* 1801

CRYSTALLOGRAPHY 548

3 : 535.333–15 : 535.375.5 *see Abstr.* 1833

3.0 : 535.375.5 *see Abstr.* 1835

3.0 : 537.226 = 3 *see Abstr.* 1863

8.7 : 535.375.5 = 4 *see Abstr.* 1836

8.7 : 539.11 *see Abstr.* 1918

8.73 : 518.42 1975

Charts for computation of *d*-values in X-ray diffraction emical analysis. BROWN, O. E. *J. Appl. Phys.*, **18**, 1–3 (*Feb.*, 1947).—The charts enable solutions of agg's equation for each of 5 standard wavelengths to read directly.

8.73 : 536.48 1976

Note on the structure of liquid helium II. REEKIE, J. oc. *Camb. Phil. Soc.*, **43**, 262–6 (*April*, 1947).— rther analysis of previous results [Abstr. 1585 (1940)]. is concluded that the arrangement of atoms most obably follows either a diamond or simple cubic nfiguration. L. S. G.

8.733 1977

A general-purpose Debye–Scherrer camera and its plication to work at low temperatures. HUME-ROTHERY, , AND STRAWBRIDGE, D. J. *J. Sci. Instrum.*, **24**, 89–91 *pril*, 1947).

8.735.44 1978

Use of punched card tabulating machines for crystallo- aphic Fourier syntheses. COX, E. G., GROSS, L., AND FREY, G. A. *Nature, Lond.*, **159**, 433–4 (*March* 29, 47).—A method, simpler than Abstr. 720 (1947) and ng Hollerith machines, is described. It is suitable for evaluation of electron densities over limited areas, d improves on the accuracy of the Beevers–Lipson ips [Abstr. 4497 (1936)].

8.736 1979

Unit dimensions and space group of Tl_2Cl_2. HÄGG, G., D JERSLEV, B. *Experientia*, **2** (*No.* 12) 495 (1946).— e space group is probably D_{3d}^2. The hexagonal cell has dimensions $a = 14{\cdot}3$, $c = 25{\cdot}1$ kX, and consists of 32 Tl_2Cl_3 units. A.

548.736.32 = 3 1980

An X-ray investigation of potassium bromide and rubidium chloride. WASASTJERNA, J. A. *Acta Soc. Sci. Fenn.*, **3** (*No.* 6) 20 *pp.* (1944) *In German.*—The intensity of reflection was compared with that of NaCl, mixed powders and photographic recording being used for Cu $K\alpha$ radiation, and single crystals and an ionization chamber for Mo $K\alpha$ radiation. The results were corrected for depression of the atomic scattering factor [Abstr. 687 (1934)]. The even reflections give the sum of the scattering factors of the + and − ions, and the odd reflections the difference, so that the scattering factor of each ion could be evaluated as a function of $\sin\theta/\lambda$. The mean-square displacements of the ions required to give the best overall fit to the theoretical *f* values was determined, and used to correct the observed values for temperature. Agreement (maximum deviation ~1 electron) with the Hartree or Fermi–Thomas values was obtained. A. J. C. W.

548.736.32 = 3 1981

An X-ray investigation of sodium fluoride, potassium iodide, and caesium iodide. WASASTJERNA, J. A. *Acta Soc. Sci. Fenn.*, **3** (*No.* 7) 19 *pp.* (1944) *In German.*—See Abstr. 1980 (1947). Only photographic measurements with Cu $K\alpha$ radiation were made on CsI. A. J. C. W.

548.736.32 = 3 1982

An X-ray investigation of the solid solutions KCl–KBr and KCl–RbCl. WASASTJERNA, J. A. *Acta Soc. Sci. Fenn.*, **3** (*No.* 8) 17 *pp.* (1944) *In German.*—See Abstr. 1980 (1947). The solid solutions contained equal molar amounts of the two salts. The mean-square displacement of the common ion was in both cases found to be considerably greater ($\sim 2\times10^{-18}$ cm^2) than its mean-square displacement in the pure salts, indicating permanent displacements from the lattice points. The mean-square displacements of the ions not common to the two salts were not greatly increased. A. J. C. W.

GEOPHYSICS 55

550.341.3 = 5 1983

Study on the maximum phase of a distant earthquake. PANNOCCHIA, G. *Ric. Sci.*, **12**, 595–610 (*May*, 1941) *In Italian.*—From records (tabulated) obtained with 3 Galitzin-Wilip seismographs in Rome of the New Zealand earthquake (Dec. 16, 1938), epicentre distance 18 400 km, vector diagrams are given showing the resultant horizontal displacements at max. phase, and, using the vertical-component records, the resultant total displacement. The rotation, not always in the same sense, of the horizontal and the amplitude ratio of horizontal to vertical displacement disagree with Rayleigh's theory. Lissajous figures of displacement are given. J. A. W.

550.341.4 = 5 1984

Determination of the hypocentric coordinates of an earthquake of near origin by the times of the direct longitudinal and transverse waves. CALOI, P. *Ric. Sci.*, **12**, 431–7 (*April*, 1941) *In Italian.*—Takahasi's graphical method [Abstr. 2392 (1929)] is given analytical expression and applied to determine epicentre and hypocentral depth of 2 recorded earthquakes, using velocities and arrival times of P_g and S_g waves. J. A. W.

550.831 : 526.77 = 5 1985

On the possibility of subsoil prospecting by the deviations of the vertical. AQUILINA, C. *Ric. Sci.*, **12**, 1126–34 (*Nov.*, 1941) *In Italian.*—Theoretical considerations of the effect on the vertical deviation of the presence of a given mass, of density different from that of surrounding rock, in a given place of the subsoil, lead to the conclusion that a gravimetric location of subsoil materials is possible under certain (stated) conditions, and a method using 3 theodolites, one of which has zenith- and azimuth-adjustments, is described. From the measurements, Eötvös' differential curvature can be computed. J. A. W.

550.837.3 = 4 1986

Schlumberger's electrical methods for exploring boreholes. MARTIN, M. *Rev. Gén. Élect.*, **56**, 5–19 (*Jan.*, 1947) *In French.*—The measurement of the resistivity of the rocks and the strength of currents in porous strata to identify the beds and obtain the inclination of the bore as well as the dip of the strata are explained. W. A. R.

550.93 : 539.155.2 = 3 *see Abstr.* 1935

METEOROLOGY 551.5

551.508 : 534.222.1 *see Abstr.* 1766

551.510.535 = 3 1987

Two kinds of abnormal *E*-layer. DIEMINGER, W *Naturwiss.*, **33**, 154–6 (*Sept.* 15, 1946) *In German.*

551.510.535 : 537.564 19

Electronic collisional frequency in the upper atmosphe GEORGE, E. F. *Proc. Inst. Radio Engrs, N.Y. Wa Electrons*, **35**, 249–52 (*March*, 1947).—The collision frequency of free electrons with neutral air molecul and atoms is calculated using recent data on temp pressure, composition and dissociation of atmosphe gases. Sets of values are worked out, for night and d day conditions. These two cases probably represent ma and min. values. The effective molecular dia. is discusse

551.510.535 : 621.396.11 : 538.566.3 *see Abstr.* 1913

551.515.3 = 3 19

On the thermodynamics of tornado formation. SCHMID F. H. *Experientia*, **2** (*No.* 12) 493–4 (1946) *In German.* Referring to an earlier paper [Abstr. 1173 (1946)], tw further processes are described which might produce t supplementary energy necessary to start torna formation.

551.543 : 525.624 19

Atmospheric oscillations. CHAPMAN, S. *Nature, Lon* **159**, 357–60 (*March* 15, 1947).—A summary of a Di cussion held at the Royal Astronomical Society Jan. 24, 1947.

551.574.1 = 5 19

The condensation of water vapour in the atmosphe ALIVERTI, G. *Ric. Sci.*, **12**, 1251–60 (*Dec.*, 1941) *Italian.*—The formation of nuclei by spray over a mari surface (salinity 3·5%) is discussed and the stability water drops is considered in detail. The presence other nuclei in the atmosphere is dealt with, and electr charge, irregularity of shape and coalescence of drops discussed. Experiments in progress in Pavia are describ and apparatus for determining the salinity of the air illustrated. Preliminary results are 0·016 mg Cl per m of air, 0·63 mg Cl per litre of sea water. J. A. V

551.574.7 19

Experiments on the stimulation of clouds to produce rai KRAUS, E. B., AND SQUIRES, P. *Nature, Lond.*, **15** 489–91 (*April* 12, 1947).—"Dry ice" (granulated CO was dropped from aircraft into clouds extending abo the freezing level on 8 occasions; radar observatio detected rain formation within the cloud on 6 occasion and rain reached the ground on 4. A brief account the meteorological conditions, and visual effects followi release of the CO_2 are given for one of the occasions.

BIOLOGY 57/59

577.15.035 : 535.37 *see Abstr.* 1827 = 3

612.85 : 534.756 *see Abstr.* 1782

612.85 : 534.843 *see Abstr.* 1786

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.84 = 5 1993

Photochemical theory of vision. DI FRANCIA, G. T. *Ric. Sci. Ricostruz.*, **16**, 1142–4 (*Aug.*, 1946) *In Italian.*—Applies the simple photochemical theory to results of Deaglio and Gedda [Abstr. 2713 (1946)] on the minimum time of perception required for light of different colours, and deduces values for the constants of the photochemical equation. J. W. T. W.

612.843.612 = 5 1994

Perception time and Weber–Fechner's law. DEAGLIO, R., AND PANETTI, M. *Ric. Sci.*, **12**, 511–12 (*April*, 1941) *In Italian.*—Results (graphs) of a series of measurements of time required for perception of a contrast as function of the brilliance of illumination. J. A. W.

613.63 19

Quantitative determination of the radium content of t human body and of the radon content of breath samples f the prevention and control of radium poisoning in perso employed in the radium industry. HESS, V. F., AN MCNIFF, W. T. *Amer. J. Roentgenol. Radium Ther* **57**, 91–102 (*Jan.*, 1947).—A double-chamber differenti ionization apparatus is described in detail. The metho has been in practical use for over two years and permi determination both of the radioactivity of exhaled breat and of Ra salts lodged in the bone tissues, etc. By th means it is possible to detect incipient Ra poisoning workers before the tolerance limit, taken as 0·1 μg, acquired. B. J.

615.849 : 539.163.2 *see Abstr.* 1945